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Crop genetic diversity to reduce pests and diseases on-farm

Participatory diagnosis guidelines. Version I

Devra I. Jarvis and Dindo M. Campilan

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Crop genetic diversity to reduce pests and diseases on-farm

Participatory diagnosis guidelines. Version I

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Introduction to the Series

The Technical Bulletin series is targeted at scientists and technicians managing genetic resources collections. Each title will aim to provide guidance on choices while implementing conservation techniques and procedures and the experimentation required to adapt these to local operating conditions and target species. Techniques are discussed and, where relevant, options presented and suggestions made for experiments. The Technical Bulletins are authored by scientists working in the genetic resources area. Bioversity welcomes suggestions of topics for future volumes. In addition, Bioversity would encourage, and is prepared to support, the exchange of research findings obtained at the various genebanks and laboratories.

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1. Participatory diagnosis: general overview

1.1. Project background

The project 'Conservation and Use of Crop Genetic Diversity to Control Pests and Diseases in Support of Sustainable Agriculture' supports conservation of crop genetic diversity *in situ* and helps enable farmers to use this to reduce pest and disease pressure and enhance sustainable agriculture production.

A key starting point for the project is understanding farmers' knowledge, practices, problems and needs for using diversity to control pests and diseases. Through participatory assessment combined with laboratory and field analysis, the project seeks to determine when and where genetic diversity of the target crop can be recommended to manage pests and diseases.

This set of guidelines provides the project team with methodological guidelines in planning and implementing participatory diagnosis. It contains the general framework and procedures for undertaking participatory diagnosis, including tools for data collection and analysis.

The guidelines go much further than providing guidance to produce descriptions of host–pest/pathogen systems on-farm. They feed into a six-step decision-making tool. The steps listed below will enable the determination of when the use of crop genetic diversity on-farm would be an appropriate option to minimize crop loss due to pests and diseases. Each step includes assessments of farmers' beliefs and practices and measured data.

- *Step 1.* Are pests and diseases viewed by both farmers and scientists as a significant factor limiting production? If so:
- *Step 2.* Does intraspecific diversity with respect to pests and diseases exist within project sites and, if not, do other sources of intraspecific diversity with respect to pests and diseases exist from earlier collections or from similar agroecosystems within the country? And/or:
- *Step 3.* Does diversity with respect to pests and diseases exist but is not accessed or optimally used by the farming communities? If so:
- *Step 4.* Is there diversity in virulence and aggressiveness of pathogens and/or diversity in biotypes in the case of pests?
- *Step 5.* Are pests and diseases moving in and out of the project sites, and if so how, and what is the role of the local seed/ propagation material systems in these movements?

- *Step 6*. What 'genetic choices' do farmers make, including using or discarding new and old genotypes, selecting criteria for hosts that are resistant and managing mixtures to minimize crop loss due to pests and diseases?

Step 1 is used to ensure that before an investment in resources is made for project implementation, the area(s) selected is one in which specific pest and disease problems have been identified as being a major issue for farmers.

Step 2 includes quantification of the amount and type of diversity of local crop varieties on-farm, not only for identifying resistant varieties, but also for understanding the potential trade-offs among resistant and non-resistant varieties in terms of production and quality traits preferred by local communities. The participatory guidelines—developed through earlier projects in Morocco (barley and durum wheat), Mexico (maize and common beans), Nepal (rice) and Uganda (banana and plantain)—were elaborated to determine whether varieties with the same name from within and among different regions are genetically the same. These guidelines will be modified for participatory determination of the extent to which the variety names and traits used by farmers can be adopted to identify amounts of diversity in respect to resistance found on-farm.

Resistance may exist in project sites or in earlier collections from project sites, or similar agroecosystems within the target countries, which is not being optimally used on-farm. Farmers may be using varieties for other purposes not associated with minimizing pests and diseases, or they may not be able to access materials that they know are resistant. In Step 3, barriers and constraints—including social, economic and knowledge barriers to diversity access—will be examined.

Step 4 includes surveys of pathogen variation (e.g. screening samples of isolates against a range of crop genotypes), and pest biotypes. Measurements will be made on insect pests and pathogens of importance and the time of their occurrence; varieties will be surveyed *in situ* for infestation levels at the appropriate times. Step 4 includes gaining an understanding of farmer classification systems for pests and pathogens. Perceptions by farmers of pest and disease variation, including whether farmers perceive that varieties are becoming more susceptible over time or more susceptible when planted in different plots or environments, and whether pesticides have become less effective, will help provide insights to the reasoning behind pest and disease management practices and the management of genetic diversity. A detailed quarantine strategy will be worked out in each country for each host–pest or host–pathogen system as part of the research guidelines. Particular care is taken to ensure that field and glasshouse or lab experiments do not introduce alien biotypes or pathotypes.

Step 5 is concerned with the mechanisms that are responsible for movement and transmission of pests and diseases within and among communities, and thus requires an understanding of the mechanisms and components of local seed systems. Identifying which persons or groups are involved in movement of seeds and other propagating material, and their awareness of pest and disease transmission mechanisms, will be key for mainstreaming and replicating practices involved with seed and clonal cleaning discussed later in this document.

Step 6 leads the decision-maker into an understanding of farmer management practices that use crop genetic diversity. Do farmers use mixtures? How are the mixtures arranged? Do farmers select for resistance? Do they choose particular varieties because they have known resistant traits, do they select particular plants within a variety to have a more resistant population, do they plant particular parts of their fields for seeds to be used the next generation? Answers to these questions will guide the development of practices and procedures that enhance the use of genetic diversity to minimize pest and disease pressures.

1.2. Participatory diagnosis

Participatory diagnosis aims to take the 'view from below', by exploring how user groups understand and act on problematic situations. Outputs of participatory diagnosis help define the agenda for subsequent project phases such as in (1) identifying and evaluating technology options that build on local knowledge and resources; (2) ensuring that technical innovations are appropriate for local socioeconomic, cultural and political contexts; (3) setting up mechanisms for wider sharing and use of agricultural innovations; and (4) monitoring and evaluating agricultural improvements resulting from the research and development process.

Participatory diagnosis is useful when the purpose of the project team is to examine problems, needs and opportunities as perceived by user groups. It complements, but does not necessarily substitute for, other research methods in which the project team directly observes and interprets the biophysical or social situations (e.g. researchers collecting soil samples for laboratory analysis).

Diagnostic studies, in general, seek to generate information about the agricultural systems being targeted for improvement through research and development. This information could be broadly grouped as that which enables R&D workers to study the (1) biophysical dimensions of particular agroecosystems, (2) the social profile of users in these agroecosystems, and (3) users' own knowledge of the biophysical and social dynamics of agroecosystems. The third category, which refers to knowledge in its broadest sense—concepts, perceptions, beliefs, values, decisions and actions—is where participatory diagnosis can be most useful.

Participatory diagnosis focuses on problem identification and prioritization. It may also cover issues/themes associated with needs and opportunities assessment, stakeholder/gender analysis, livelihood systems assessment, documentation of local knowledge and baseline studies. The table below shows an overview of participatory diagnostic methods.

Participatory diagnosis – overview of methods[1]

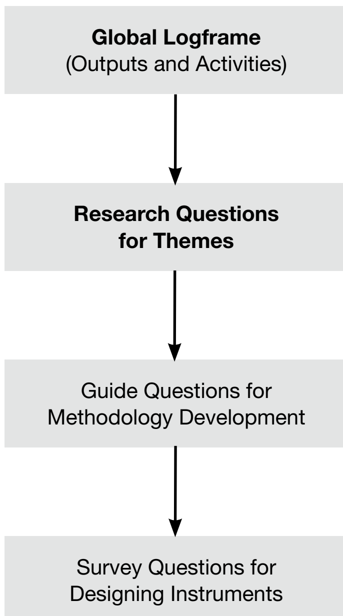
Method	Purpose	Types and examples
Interviewing	To assess knowledge and perceptions	Structured, semi-structured, unstructured, individual, group, focus group discussion
Field observation and record-keeping	To directly observe and inspect	On-site observation, season-long record-keeping
Direct physical measurement	To measure physical attributes	Using scientific measurement tools, adapting local units of measurements
Specimen collection	To collect and subsequently characterize and analyze	Sampling, inventory
Experimentation	To test and observe biophysical processes, performance and outcomes	Trials, field monitoring
Participatory diagramming and visualization	To illustrate and explain processes, relationships and structures	Line drawing, chart-making
Participatory mapping	To locate and orient	Transect mapping, marking boundaries
Participatory ranking and scoring	To categorize, prioritize and compare	Matrix ranking, sorting
Participatory observation	To document processes	Various ethnographic techniques
Games and role-playing	To document behaviours, decision-making and group dynamics	Folk games, storytelling
Modelling and use of visual tools	To show and refer to tangible examples	Constructing small-scale models, posters
Listing	To identify and inventory	Checklist, brainstorming and card technique
Testing	To rate using standardized schemes	Knowledge test, skills contest

[1] See reference section for list of manuals that describe in detail the different methods.

2. Key research questions

The global logframe contains the key research questions that serve as the key reference for determining the scope and focus of data collection.

The research questions are formulated into guide questions for data collection. The latter are categorized under the eight themes of the project's research agenda.



2.1. Global logframe summary of outputs and activities

OUTPUT 1 – Criteria and tools to determine when and where intraspecific genetic diversity can provide an effective management approach for limiting crop damage caused by pests and diseases.

Activities involve participatory determination/diagnosis of:

- whether pests and diseases are the limiting factor for the farmers
- whether intraspecific diversity with respect to the pests and diseases exists within project sites and, if not, whether other sources of intraspecific diversity exist from earlier collections or from similar agroecosystems within the countries

- whether diversity with respect to pests and diseases exists but is not accessed or optimally used
- whether in the case of disease there is diversity in virulence and aggressiveness of pathogens
- understanding how and if pests and diseases move in and out of sites/systems.

OUTPUT 2 – Practices and procedures that determine how to optimally use crop genetic diversity to reduce pest and disease pressures.

Activities can be grouped into the development and testing of four types of practices/procedures:

- examining farmers' ongoing practices using intraspecific diversity to manage pest and disease pressures
- planting intraspecific mixtures (experiments with farmers)
- integrate national stress/resistance breeding procedures with farmer selection practices and local material
- simulation modelling across temporal and spatial scales.

OUTPUT 3 – Enhanced capacity of farmers and others to use local crop genetic diversity to manage pest and disease pressures.

Activities for capacity-building will be at three levels:

- farmers and farmer communities
- local institutions, local schools, local research stations
- national research and development institutions in agriculture and the environment.

OUTPUT 4 – Actions that support the adoption of genetic-diversity-rich methods for limiting damage caused by pests and diseases.

Activities will include promoting the following actions:

- documentation of successful procedures
- comparison with non-diversity-rich options
- economic analysis of benefits to farmers and to ecosystem health
- collaboration/integration into extension packages with agricultural extension services and non-governmental organizations
- supporting seed-cleaning activities and institutions (local and others)
- adapting national breeding strategy to include farmers' knowledge and local materials
- working with education sectors
- agreeing on guidelines for benefit-sharing of new varieties and methods of diversity management.

2.2. Guide thematic questions

In the following tabulated summary, for each thematic question the sources of information should be recorded, including Titles of Documents/Names of People, and Research Methods Used in Data Gathering.

Types of information	Guide thematic questions
Theme 1. Landrace identification and characterization	What landraces are found in the local farming community? What are their key characteristics as described by farmers and/or scientists? What is the amount and distribution of these landraces and populations?
Theme 2. General perception of pest and disease problems	How do farmers view the importance of pest/disease problems in their crops? How do they assess their likelihood of effectively managing these pests/diseases?
Theme 3. Farmers' knowledge of pathogen and pest variation	What do farmers know about pathogen and pest variation? How do farmers assess diversity in virulence and aggressiveness? What is the experimental assessment of virulence and aggressiveness?
Theme 4. Farmers' knowledge on the link between pests/diseases and intraspecific diversity	What do farmers know about host diversity with respect to pests/diseases? What do farmers know about the link between pests/diseases and crop diversity and related factors? What do scientists know about these, based on the local situation and in similar agricultural environments?
Theme 5. Farmer practices that use intraspecific diversity to manage pests and diseases	To what extent do farmers use the available intraspecific diversity to manage pests and diseases?
Theme 6. Farmers' access to intraspecific diversity to manage pests and diseases	What are the ways through which farmers access these intraspecific materials, including information about them? What are the key constraints faced by farmers in the optimal access and use of intraspecific diversity?
Theme 7. Pest and disease movement and transmission	What mechanisms are responsible for movement and transmission of pests/diseases within and among communities? Which people or groups are involved in the movement and transmission? What is the level of farmers' awareness and understanding of these movements/transmissions?
Theme 8. Building on farmers' knowledge and practices	What existing farmers' knowledge and practices in the use of intraspecific diversity to manage pests/diseases can be tapped, enhanced and/or promoted more widely?

3. Selection of methods

For each of the guiding themes described in section 2.2, specific guide questions are developed. For each question, a decision is made on the method to be used to collect the information, as per the example below.

Question	Participatory diagnostic data				
	Focus group discussion (Group-level data within the partner village)	Community-based data (Partner-village-level data)	Individual interviews (Single person's data within a partner village)	Secondary data	Technical assessment
Theme 1					
Question 1					
Question 2					
Question 3					
Question...					
Theme 2					
Question 1					
Question 2					
Question 3					
Question...					

3.1. Guide questions for methodology development

These guide questions (see following table) are based on the output of Farmer Diagnostic Meetings in China and Morocco.

Guide questions based on the seven guiding themes

(Note to Facilitator: for Focus group discussion, use group data [5 groups per partner village per crop]; for Community-based data, use partner-village-level data; for Individual interviews, use single person's data [30 male and 30 female informants per crop per village].)

	Participatory diagnostic data				
	FGD	**Community-based data**	**Individual interviews**	**Secondary information**	**Technical assessment**
Theme 1: Landrace identification and characterization (includes farmer and researcher characterization of traits and genetic diversity of local varieties)					
Theme 1a. Community level					
1a.1 What is the total area planted to the crop in your village/community?		Key informant survey			
1a.2 What varieties do you grow in your village and in your community?	X			Reports	Review of *ex situ* collections
1a.3 Of these varieties, which are local and which are introduced/modern?	X			Technical Reports	
1a.4 How are these varieties distinguished from each other?	X Visual tools			Reports	On-farm trial (as support tool for FGD)
1a.5 Do you know other varieties in your village/community? Which ones?	X			Reports and *ex situ* collections	
1a.6 Do you know other varieties that are no longer cultivated in your village/community (e.g. were cultivated before but are not now)?	X			Reports and *ex situ* collections	Review of *ex situ* collections
1a.7 Why are they no longer cultivated?	X				
1a.8 Are there particular people in your village who are known to have many different varieties? Who?	X	Key informant survey		Reports	
Theme 1b. Farm level					
1b.1 What is the total area planted to your crop?			X		
1b.2 What percentage of your land for this crop is planted to local varieties?			X		
1b.3 What other varieties are you growing now?			X		Sample collection and diversity assessment
1b.4 What varieties have you grown in your field for the last five years?			X		Sample collection and diversity assessment

	Participatory diagnostic data				
	FGD	Community-based data	Individual interviews	Secondary information	Technical assessment
1b.5 Why do you plant each variety?			X Matrix ranking		
1b.6 What is the land area devoted to each variety planted this year?					
1b.7 What proportion of each of these varieties is planted in your farm in this season?			X Matrix ranking Mapping		Sample collection
1b.8 Why did you plant this much/these proportions for the different varieties?			X Matrix ranking		
Theme 2: General perceptions of pests and diseases (includes farmers' perceptions and experimental documentation)					
2.1 How do you distinguish a healthy plant from a non-healthy plant?	X Specimens collected by farmers				Sample collection, pest and disease characterization
2.2 How important are pests and diseases in affecting the health of your crop?	X				Site evaluation of the rate of infestation
2.3 What are the characteristics of a diseased plant?	X Specimens collected by farmers				
2.4 What causes a sick plant?	X Diagramming				
2.5 What diseases and pests do you find in your crop (names and descriptions of pests and diseases)?	X Specimens collected by farmers		X Specimens collected by farmers	Reports	Field inspection with farmers; pest and pathogen collection; characterization
2.6 How do you recognize the effect/damage of each one (what are the symptoms of each)?	X Specimens collected by farmers				Field identification
2.7 What are the effects of each pest/disease on the crop (yield loss, others)?	X Matrix ranking	Key informant survey	X Matrix ranking	Reports and documents	Yield loss trials

	Participatory diagnostic data				
	FGD	**Community-based data**	**Individual interviews**	**Secondary information**	**Technical assessment**
2.8 What part of the plant is affected?	X Specimens collected by farmers			Scientific literature	
2.9 When is the plant affected (seedling, at harvest, during storage)?	X				
2.10 Is there a use for the affected parts of plants (animal feed, others, cooking)?	X				
Theme 3: Knowledge of pathogen and pest variation (includes farmers' knowledge and biotype variation from experimentation). Does the population structure of pests ans pathogens vary across systems and in space?					
3.1 Do you know of any variety that became susceptible?	X			Reports and documents	
3.2 Why do you think the variety became susceptible? *(Note: Question for development of belief statements* [1] [2]	X		X Belief statements based on FGD	Reports and documents	
3.3 What are the consequences of continuous pesticide use year after year on pests or diseases? *(Note: Question for development of belief statements)*[3]	X		X Belief statements based on FGD		
3.4 How much does the genetic make-up of pest and pathogen populations vary among farms and over time?					Plant variability assessment, pest and pathogen collection and characterization

[1] Belief statements allow quantification of changes in farmers' beliefs over time. Belief statements will be developed based on FGD outputs.
[2] The statements will then be used to monitor, at the beginning and end of the project, changes in farmer's beliefs within the different thematic questions.
Example of belief statements for question 3.2:
- Modern varieties become more susceptible if you grow them year after year.
- Local varieties do not become more susceptible if you grow them year after year (depending on disease, e.g. blast).
- Varieties become susceptible if you grow them next to susceptible varieties.
- Varieties are attacked more often by insects if you grow them year after year.

[3] Example of belief statements for question 3.3:
- The effectiveness of the pesticide edclines over time

	Participatory diagnostic data				
	FGD	**Community-based data**	**Individual interviews**	**Secondary information**	**Technical assessment**
Theme 4: Link between pests and diseases and intraspecific diversity (includes farmer knowledge and experimental information on host resistance and diversity and field resistance). Host diversity — among and within traditional crop cultivars, what genetic variation for resistance exists against the pathogen populations they harbour? Diversity and field resistance — does the resistance diversity present in a crop actually reduce pest and disease pressure and vulnerability, at least in the short term?					
Theme 4a. Diversity of resistance of local varieties					
4a.1 Are there differences in resistance between varieties? At what growth stage of the plant?	X Matrix ranking			Reports and documents	Assessment of resistance interaction/ epidemiology
4a.2 Are there differences in tolerance or resistance of varieties to post-harvest (storage) pests?	X Matrix ranking			Reports and documents	Assessment of plant variability
4a.3 What criteria do you use to distinguish varieties based on resistance?	X Matrix ranking				
4a.4 How do the varieties differ in degree of resistance/ tolerance?	X Matrix ranking				Assessment of plant variability and resistance mechanisms
Theme 4b. Changes in diversity over time and space					
4b.1 Does growing the same variety for a long time make the crop vulnerable to pest and disease attacks? *(Note: Question for development of belief statements)*[4]	X		X Belief statements based on FGD		
4b.2 Do varieties differ in durability of resistance? *(Note: Question for development of belief statements)*[5]	X		X Belief statements based on FGD		
4b.3 How many years have you been growing the same varieties in your farm?	X		X		

[4] Example of belief statements for question 4b.1:
- Modern varieties become more susceptible if you grow them year after year.
- Local varieties do not become more susceptible if you grow them year after year (depending on disease, e.g. blast).
- Varieties become susceptible if you grow them next to susceptible varieties.
- Varieties are attacked more often by insects if you grow them year after year.

[5] Example of belief statements for question 4b.2:
- All resistant varieties stay resistant for the same period of time.

	Participatory diagnostic data				
	FGD	Community-based data	Individual interviews	Secondary information	Technical assessment
4b.4 What happens if you continue to grow the same varieties for a long time? *(Note: Question for development of belief statements)*[6]	X		X Belief statements based on FGD		
4b.5 What are the reaction(s) to the pathogen of the same varieties planted in different locations or different years?[7]	X		X Belief statements based on FGD		Characterization of the environment, assessment of field resistance and epidemiology
Theme 4c. Distribution					
4c.1 Within your village, how are the target crops distributed?		Mapping (community walk)			Satellite photography
4c.2 How do you distribute or deploy your varieties among plots (mosaics)? Why?			X Mapping		Plot characterization
4c.3 How do you distribute or deploy your varieties within plots? Why?			X Mapping		
4c.4 How do you distribute or deploy your varieties over time? Why?			X Mapping		Annual sampling
Theme 5: Practices for managing pests and diseases					
Theme 5a. General practices					
5a.1 How do you manage your crops for pests and diseases?	X				

[6] Example of belief statements for question 4b.4:
- Modern varieties become more susceptible if you grow them year after year.
- Local varieties do not become more susceptible if you grow them year after year (depending on disease, e.g. blast).
- Varieties become susceptible if you grow them next to susceptible varieties.
- Varieties are attacked more often by insects if you grow them year after year.

[7] Example of belief statements for question 4b.5:
- Some varieties are more resistant than other varieties in drought years.
- Some varieties are more resistant than other varieties on certain soils and management variables.

	Participatory diagnostic data				
	FGD	**Community-based data**	**Individual interviews**	**Secondary information**	**Technical assessment**
5a.2 Do you use pesticides?			X Mapping		
5a.3 How much on each plot?					
Theme 5b. Management of pests and diseases with intraspecific diversity					
5b.1 Does changing varieties help to control pests and diseases? *(Note: Question for development of belief statements)*[8]	X		X Belief statements based on FGD		
Theme 5c. Spatial arrangement of varieties					
5c.1 Do you grow different varieties of a crop together (mixtures)?	X		X		
5c.2 Why do you grow different varieties of a crop together (use mixtures)? Why not? (*Note: Question for development of belief statements)*[9]	X		X Belief statements based on FGD		
5c.3 Which varieties (of a single crop) do you grow together?			X		
5c.4 How are the varieties arranged together now? How could they be arranged (have you ever used other arrangements)?	X		X Diagram		Trials
5c.5 Did you ever grow different varieties together in the past? How were they arranged?	X		X Belief statements based on FGD		

[8] Example of belief statements for question 5b.1:
- Changing where you plant varieties reduces pests and diseases.
- Changing proportions of different varieties reduces pest and disease pressures.

[9] Example of belief statements for question 5c.2:
- Planting mixtures gives me more income from production.
- Planting mixtures is more costly than uniform planting.
- The best way to reduce disease in the rice crop is by using mixtures

	Participatory diagnostic data				
	FGD	Community-based data	Individual interviews	Secondary information	Technical assessment
5c.6 What is the effect of spatial arrangements on reducing pests and diseases?	X		X Belief statements based on FGD		Field assessment
Theme 5d. Temporal arrangement of varieties					
5d.1 Do you make temporal arrangements of varieties (i.e., replacing one variety with another over time in the same plot)			X		
5d.2 Which varieties do you rotate with other varieties (within the same crop)?			X		
5d.3 What is the effect of replacing one variety with another in the same plot over time?	X		Belief statements based on FGD		
Theme 5e. Selection for resistance					
5e.1 How do you compare the resistance of selected or certified varieties vs. traditional/local varieties? Under what conditions?	X				
5e.2 Are there any specific varieties you chose for tolerance or resistance to pest and disease attacks?	X List from earlier Matrix ranking	X List from Matrix ranking			Plant variability assessment, and resistance interaction/ epidemiology
5e.3 What criteria do you use to choose these varieties?	X List from earlier Matrix ranking	X List from Matrix ranking			Plant variability assessment, and resistance interaction/ epidemiology
5e.4 Within a variety do you select? (Note: not necessarily selection for resistance — could be indirect selection) Are any of these practices related to resistance/tolerance?	X		X		Compare to breeder selection practices
5e.5 What criteria do you use?			X		Field trials
5e.6 When do you practise selection (what stage of the plant)?			X		Field trials

	Participatory diagnostic data				
	FGD	Community-based data	Individual interviews	Secondary information	Technical assessment
5e.7 Where do you practise selection: in the field, in the house?			X		Field trials
5e.8 Which part of the field or plot?			X		Field trials
5e.9 Which part of the plant do you select?			X		Field trials
5e.10 Are any of these practices related to resistance/ tolerance?			X		Field trials
Theme 6: Access and barriers to diversity use					
6.1 Where do you get your seeds (from whom)?	X Diagram		X Diagram	Reports Documents	
6.2 How often do you change seeds for each variety?			X		
6.3 Do you have problems getting seeds you have heard about? (Social barriers, economic barriers; from your village, community, region)	X		X Diagram		
Theme 7: Pest and disease movement and transmission					
7.1 Where do pests and diseases come from? *(Note: Question for development of belief statements)*[10]	X		X Belief statements based on FGD		
7.2 Are there people in your village who often sell/distribute/ exchange seeds to farmers in the village? Who?	X		X		
7.3 Do you usually have the same disease damage as your neighbours? Why or why not?	X Reason why or why not				Field visits
7.4 Performance of seeds obtained from other farmers *(Note: Question for development of belief statements)*[11]	X		X Belief statements based on FGD		

[10] Example of belief statements for question 7.1:
- Diseases/pests come from dew.

[11] Example of belief statements for question 7.4:
- Seeds obtained from other farmers are prone to pest and disease attack.
- If you exchange seeds with other farmers, pests and diseases will increase.

	Participatory diagnostic data				
	FGD	**Community-based data**	**Individual interviews**	**Secondary information**	**Technical assessment**
7.5 Do your neighbours usually get more pest/disease damage than you? Why? (same as 7.3.)			X		Direct observation Field observation
7.6 What seed management practices do farmers use to prevent pest and disease attack? (*Note: Question for development of belief statements*)[12]	X		X Belief statements based on FGD		
7.7 What precautions do you take in storing your seeds to avoid pest and disease damage?	X				
7.8 Do you practise selection or cleaning or screening to obtain healthy seed? Methods and criteria?	X		X		Direct observation
Theme 8: Building on farmers' and researchers' knowledge and practices					
8.1 How can the control of pests and diseases be improved in your community? (options)	X				
8.2 How can the control of pests and diseases be improved in your farm?			X		
8.3 What are the practices you would advise others to use, or you would use more widely if you could?	X		X (use list from FGD)		
8.4 Are you aware of other practices that farmers use (outside of the community)?	X				
8.5 What practices should be avoided?	X		X (use list from FGD)		

[12] Example of belief statements for question 7.6:

- Farmers should use clean seeds every season to prevent pest and disease attack.

4. Criteria and selection of host (crop), pests and diseases, sites and participants/respondents

4.1. Criteria for host (crop), pests and diseases

Crops were selected to cover a range of breeding and farmer management systems. Pests/pathogens were selected to cover those that are determined by major and minor genes (one gene or a complex of genes provide resistance), seed-borne, soil-borne and air-borne diseases, and pathogens/pests affecting different plant organs (aerial parts and roots). Countries were selected based on the significance of the pest/disease, the capacity within the country to cover the selected systems, existing in-country initiatives upon which the project can build, and each country's demonstrated commitment to conservation of agrobiodiversity.

Host (crop) properties
Variation for reaction to pests and diseases exists among local varieties
Yield losses due to pests or diseases are significant

Host–pest and host–pathogen interaction
Critical in on-farm management of intraspecific diversity
Differential responses known to occur

Pathogen or pest properties
Species are genetically diverse
Variation in pathogenicity exists for target area

Long-term benefits
Reduced risk of production loss over time
Reduced yield loss due to pests and diseases
Reduced year-to-year fluctuation in disease losses

Farmer benefits
The system is a good point for integrating pest/disease control
Increased yield and income for farmers
Farmer profits will be increased
Farmer livelihood options improved

Conservation benefits
Increased likelihood of maintaining a number of local cultivars
Reduced use of chemical controls
Improved environment: ecological service functions benefit

Habitat and abiotic environment
Environmental heterogeneity (temporal and spatial) is present (= variable selection pressure)
Cropping system has been in place for a long time with the identified pathogen or pest pressures

Basic information already available
Diversity detection techniques and markers are available or easily developed and have widespread application
Farmers have long-term knowledge and management base
Knowledge of diversity and its significance already exists

Basic principles
Pests and diseases that are of economic importance and have already been characterized
Production systems that use minimal or no pesticides
Subsistence food crops (as opposed to cash crops)
Work to take place in developing countries
Host or pest systems where diversity management is a viable strategy

Single vs. multiple systems
Possibility of targeting multiple pests and diseases with multiple mechanisms to achieve long-term stability
Possibility of working jointly with single host–pathogen systems and with multiple systems

Logistics and practicalities
Institutional resources are appropriate and available
Sites with reasonable access can be identified

Traditional varieties used in production
Participatory approaches can be implemented at all stages
Products (methods and technologies) can be developed for farmer adoption

Selected host (crop)/pest—pathogen systems for China, Ecuador, Morocco and Uganda

Crop	Breeding system	Pest/ Pathogen	Gene	Seed-borne	Tissue damaged	Country
Maize *(Zea mays)*	Outcrossing	Leaf blight	Major and minor	No	Leaf	China, Ecuador
		Stem borer	Minor	No	Stem	China, Ecuador
Faba bean *(Vicia faba)*	Partial outcrossing	*Botrytis fabae*	Minor	Yes	Leaf, stem	Morocco, China
		Ascochyta blight	Major and minor	Yes	Leaf, stem, seed	Morocco
		Soil-borne diseases	Major and minor	No	Root, seed	Ecuador
		Rust	Major	No	Leaf	Ecuador, China, Morocco
Rice (*Oryza sativa)*	Inbreeding	Blast	Major and minor	Yes	Leaf, node, panicle	China
		Brown plant-hoppers	Major	NA	Leaf, foliage	China
		Leafhoppers	Major and minor	NA	Leaf, foliage	China
		Stem borer	Major and minor	No	Stem	China
Common bean (*Phaseolus vulgaris*)	Inbreeding	Rust	Major and minor	No	Leaf, stem	Ecuador, Uganda
		Anthracnose	Major	Yes	Leaf, stem, pod	Ecuador, Uganda
Barley (*Hordeum vulgaris*)	Inbreeding	Yellow rust	Major and minor	No	Leaf, head	China, Morocco
		Brown rust	Major and minor	No	Leaf, head	Morocco
Banana and plantain (*Musa* spp.)	Clonal	Black Sigatoka	Major and minor	No	Leaf	Uganda, Ecuador
		Banana Streak Virus	Interpr. sequences	Yes	Leaf, stem	Uganda
		Nematodes	Unspecified	No	Root	Uganda, Ecuador

4.2. Criteria for site selection within countries and host–pest/pathogen systems

Each site constitutes a 'community' representing a village or contiguous villages determined by local geographic and socio-political contexts.

Site selection criteria are as follows:

Environment
• Magnitude of diversity • Diversity and agroecological variables
Crop
• Intraspecific diversity • Local adaptations • Continuum of diversity from resistant to susceptible • Crop to be a main component of the system at the site
Pests and pathogens
• Distribution • Diversity of types • Environmental responses
Farmers and communities
• Knowledge among farmers of pest/disease management (e.g. able to identify the symptoms) • Knowledge among farmers of old and new varieties • Socio-cultural and diversity • Livelihood diversity • Market opportunities • Diagnostic on-farm information on biological constraints
Partners
• Community cooperation • Conservation interventions • Institutional capacity • Expertise available near site on pest and disease management (e.g. entomologist, pathologist, etc.)
Logistics
• Year-round access • Resource availability • Availability of experimental stations

4.3. Regional site and village sites

Country/region	Site/region (Site Coordination Teams)	Crops
China		
Yunnan	Yuanyang	Rice
	Kunming	Rice,
	Xun Dian	Maize, Faba bean
	Zhongdian (Shangri-la)	Barley
	Songming	Barlery
	Menghai	Rice
	Jinning	Faba bean
Sichuan	Nanjiang	Maize
	Qiong Lai	Rice
Guizhou	Wudang	Rice
Total	10 (Site Teams)	
Ecuador		
	Cotacachi	Maize, Common bean
	Santo Domingo	Musa
	San Ramon	Musa
	Tenta	Maize, Common bean
	Turupamba	Faba bean
	Cochabón	Maize, Common bean
	Gañil	Faba bean
Total	7 (Site Teams)	
Morocco		
	Ourtzagh	Faba bean, Barley
	Ghafsai	Faba bean, Barley
	Tissa	Faba bean, Barley
	Taza	Faba bean, Barley
Total	4 (Site Teams)	
Uganda		
	Nakaseke	Common bean, Musa
	Kabawohe	Common bean, Musa
	Bunyaruguru	Musa
	Kabale	Common bean
Total	4 (Site Teams)	
Grand total	**18 (Site Teams)**	

Total number of participatory data samples

Country	Number of partner villages						
	Rice	Barley	Maize	Common bean	Faba bean	Musa	Total
China	5	2	2	—	2	—	11
Ecuador	—	—	3	3	2	2	10
Morocco	—	4	—	—	4	—	8
Uganda	—	—	—	3	—	3	6
Total	5	6	5	6	8	5	35

Sample numbers for diagnostic methods for (a) farmer's beliefs and practices and (b) field and laboratory assessment

Samples for diagnostic methods	Crop						
	Rice	Barley	Maize	Common bean	Faba bean	Musa	Total
Farmer's beliefs and practices							
FGD x 6	30	36	30	36	48	30	210
Individual survey x 60	300	360	300	360	480	300	2100
Community level mapping x 2 (partner village level)	10	12	10	12	16	10	70
Key informant interviews: three types per partner village	15	18	15	18	24	15	105
Field and laboratory assessment[1]							
Observation In Situ in farmers'fields: Quantification of the infestation - transects, scoring disease/pests							
On-Farm trials: Resistance under farmers' conditions. Growing out populations of each of the varieties together with a set of differential varieties							
Collection of isolates: Preparation of Experimental station trials, and identification of variation the pest and pathogen							
Experimental station –field trials: Following the epidemic over time (seedling responses, disease progress, effect on yield							
Glass house experiments: maximizing interactions: richness and evenness of interactions							

[1] Sample sizes for technical assessment of host diversity, biotype diversity, resistance diversity and diversity and field resistance are still to be agreed upon.

Total number of participatory data samples

Country	Number of partner villages					
	Total crop per site	FGD x 6	Individual interviews x 60	Community level x 2 (partner village level)	Key informants x 3	Individual x populations x varieties x plots for technical assessment
China	11	66	660	22	33	
Ecuador	10	60	600	20	30	
Morocco	8	48	480	16	24	
Uganda	6	36	360	12	18	
Total	35	210	2100	70	105	

4.4. Participant selection within sites

Respondents for sample survey

1. In each site, the questionnaire survey will include a sample of 10% of farming households growing the crop for the current season. Sample size may be adjusted to ensure that the total number of respondents is at least 60 households growing the target crop within a random sample or all households in the site. Thus, one might randomly sample 80 households so that at least 60 of them are growing each of the target crops. Fundamentally, we want to make our generalizations for the total population of farmers in the village because we want to minimize any bias (crop or pests).
2. Cluster sampling by village/subvillage will be used to ensure geographic representation across the community. A community can include one or more villages that have seed exchange or shared seeds, pathogen movement or shared diseases. The idea is to aim at 10% (60 households) of a human population (i.e. 600 households) that our sample is representing.
3. For the farming households in the sample, random sampling will be done to identify who within the household will serve as respondent.
4. Fifty percent of households will be interviewed through an adult male member as respondent; the other half will be through a female adult member. Thus for each partner village there will be 30 individual surveys from a male respondent and 30 individual surveys from a female respondent.
5. Random samples are done by putting a list of all household names into a box and randomly selecting the number of houses needed + 10% extra names (as back-up households if a respondent does not want to participate, or is not available. This is called adjusting for 'mortality' and is a statistically recognized procedure. Therefore for each site a minimum of 66 household names would be selected of which 33 would be used for male respondents (in case 3 male farmers were not available, the 3 in reserve could replace them) and 33 for female respondents (likewise in case 3 female farmers were not available, the 3 in reserve could replace them).

Participants in focus group discussions (FGD)

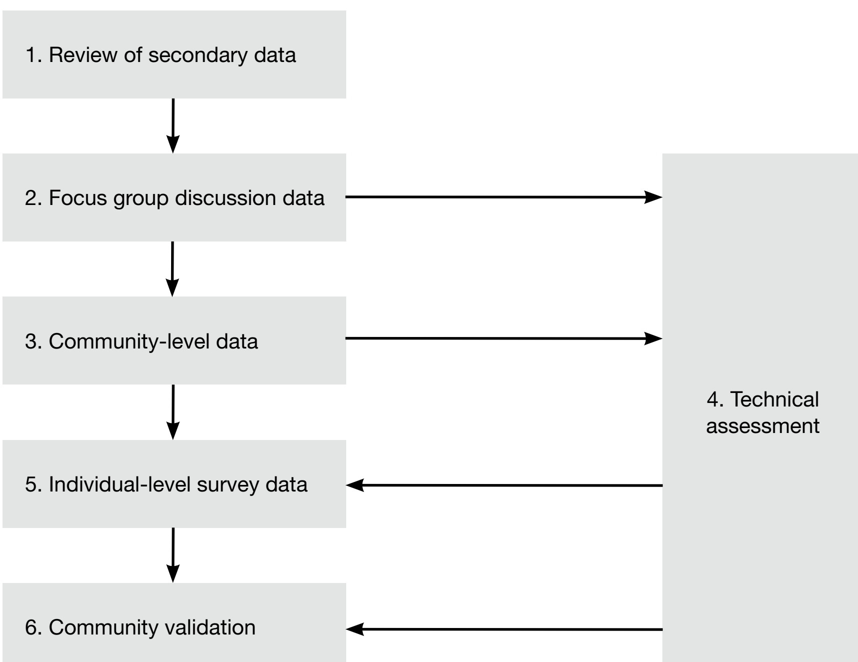
1. In each site, there will be a minimum of six FGD sessions, one each for: (a) older[1] male farmers, (b) younger male farmers, (c) older female farmers, (d) younger female farmers, (e) community leaders and (f) extensionists.
2. Each FGD group must have a minimum of 10 participants. They will be purposively selected to ensure representation across the villages/subvillages.
3. Additional FGD groups may be identified depending on local social, cultural and economic heterogeneity.

[1] No set age is used to distinguish 'older' and 'younger' farmers; these categories should be site specific and based on the village or site perception of distinguishing the two groups.

5. Phases in data collection

5.1. Overview of phases and methods

Phases	Data	Tools
1. Review of secondary data	Technical and background socioeconomic information	Data checklist
2. Focus group discussion	Community/group-level data; Suggestions for formulating questions for sample survey	FGD guide with participatory rural appraisal (PRA) tools
3. PRA	Community/group-level data	PRA tools
4. Technical assessment	Biophysical data	Guidelines for technical assessment
5. Sample survey	Farm/household-level data	Questionnaire with PRA tools
6. Community validation meeting	Feedback on preliminary analysis	FGD guide



5.2. Schedule of implementation and training support

(See following table)

M/T/F[1]	Training/meeting	Module content	Participants	Facilitators	Timing
M1	International Steering Committee Meeting		National Project Directors (China, Ecuador, Morocco and Uganda); Global Project Director; International partners		
M2	National Steering Committee Meetings		National Project Director; National Steering Committee Members		
M3	Site Team meeting		National team representative + Site team members		
T1	Global training on standardizing technical data and introduction to collection and participatory diagnosis	*Part 1: Standardizing technical sampling* Technical sampling standardization by crop (agree on number of samples, sampling methods; experimental design by crop) *Part 2: Participatory diagnostics* Participatory diagnostics (PD) general overview PD data collection and field work PD data processing PD data analysis	*China* – Total 6 (at least 2 females): 1 Rice GD[2], 1 Barley GD, 1 Faba bean GD, 1 Maize GD, 1 Entomologist, 1 Pathologist *Ecuador* – Total 6 (at least 2 females): 1 Maize GD, 1 Common bean GD, 1 Faba bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist *Morocco* – Total 4 (at least 1 female): 1 Barley GD, 1 Faba bean GD, 1 Entomologist, 1 Pathologist *Uganda* – Total 4 (at least 1 female): 1 Common bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + *4 National Project managers* Total = 24	*Part 1:* Technical Advisors in crop genetic diversity, plant pathology, entomology *Part 2:* National Project Directors	
T2	Site-level training in crop genetic diversity assessment, pathology and entomology	Short courses in pathology, entomology and crop genetic diversity for site-level staff – to build capacity of site-level focal technical staff in data collection and data analysis	Focal site level staff (i.e. focal person for each crop in the partner villages of the site + 1 focal person for pathology and 1 focal person for entomology) *Note: in each country a network is set up so that national focal points for each crop and pathology and entomology each have a network of local people who are trained in each discipline*	National focal points for crop genetic diversity (each target crop); pathology, entomology	
T3A	China national training on standardizing technical data collection and participatory diagnosis	Technical sampling standardization by crop Participatory diagnostics (PD) general overview PD data collection and field work PD data processing PD data analysis	2 China NSCC[3] members (1 male + 1 female) 2 Yuanyang ST[4] members (1 male + 1 female) 2 Kunming ST members (1 male + 1 female) 2 Zhongdian ST members (1 male + 1 female) 2 Menghai ST members (1 male + 1 female) 2 Qionglai ST members (1 male + 1 female) 2 Meitan ST members (1 male + 1 female) Total: 14 (7 male +7 female)	Chinese people trained in T1: 1 Rice GD, 1 Barley GD, 1 Faba bean GD, 1 Maize GD, 1 Entomologist, 1 Pathologist + National Project manager	

[1] M = Meeting; T= Training and Workshops; F= Field Work and Data Analysis.
[2] GD= Genetic diversity specialist.
[3] NSCC = National Site Coordination Committee.
[4] ST = Site Team.

M/T/F[1]	Training/meeting	Module content	Participants	Facilitators	Timing
T3B	Ecuador national training on standardizing technical data collection and participatory diagnosis	Technical sampling standardization by crop Participatory diagnostics (PD) general overview PD data collection and field work PD data processing PD data analysis	2 Ecuador NSCC members (1 male + 1 female) 2 Carchi ST members (1 male + 1 female) 2 Imbabura ST members (1 male + 1 female) 2 Bolivar ST members (1 male + 1 female) 2 Cañar ST members (1 male + 1 female) 2 Loja ST members (1 male + 1 female) 2 Manabi ST members (1 male + 1 female) Total: 14 (7 male +7 female)	Ecuador people trained in T1: 1 Maize GD, 1 Common bean GD, 1 Faba bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + National Project manager	
T3C	Morocco national training on standardizing technical data collection and participatory diagnosis	Technical sampling standardization by crop Participatory diagnostics (PD) general overview PD data collection and field work PD data processing PD data analysis	2 Morocco NSCC members (1 male and 1 female) 2 Ourtzagh ST members (1 male + 1 female) 2 Ghafsai ST members (1 male + 1 female) 2 Tissa ST members (1 male + 1 female) 2 Oued Amlil ST members (1 male + 1 female) Total: 10 (5 male + 5 female)	Morocco people trained in T1: 1 Barley GD, 1 Faba bean GD, 1 Entomologist, 1 Pathologist + National Project manager	
T3D	Uganda national training on standardizing technical data collection and participatory diagnosis	Technical sampling standardization by crop Participatory diagnostics (PD) general overview PD data collection and field work PD data processing PD data analysis	2 Uganda NSCC members (1 male + 1 female) 2 Bushenyi ST members (1 male + 1 female) 2 Luwero ST members (1 male + 1 female) Total: 6 (3 male +3 female)	Ugandan people trained in T1: 1 Common bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + National Project manager	
T4	Site-level training on standardizing technical data collection and participatory diagnosis; 18 Sites	Technical sampling standardization by crop Participatory diagnostics (PD) general overview PD data collection and field work	At least 4 field assistants per village (2 male + 2 female) Total number training workshops and people trained per country: *China* – 6 training workshops; 20 partner villages x 4 = 80 people trained *Ecuador* – 6 site training workshops; 10 partner villages x 4 = 40 people trained *Morocco* – 4 site training workshops; 10 partner villages x 4 = 40 *Uganda* – 2 site training workshops; 8 partner villages x 4 = 32 people trained Total trained for partner village data collection = 192	Facilitators are site-level people trained under Training 2A-D	

M/T/F[1]	Training/meeting	Module content	Participants	Facilitators	Timing
F1	Partner village data collection	Conduct: FGD (6 per partner village per crop) Conduct: community mapping (may be necessary for 2 [1 male + 1 female] in some countries) Conduct: Technical assessment–crop variety sample collection at partner village level	Site teams + national site committee experts for each crop (if the crop is located in that partner village) and pathologist and entomologist		
T4	Global workshop on data processing and analysis (*only after field work is completed)*	Developing the coding guide first draft Training sessions on processing and analysis of PD data	*China* – Total 6 (at least 2 females): 1 Rice GD, 1 Barley GD, 1 Faba bean GD, 1 Maize GD, 1 Entomologist, 1 Pathologist *Ecuador* – Total 6 (at least 2 females): 1 Maize GD, 1 Common bean GD, 1 Faba bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist *Morocco* – Total 4 (at least 1 female): 1 Barley GD, 1 Faba bean GD, 1 Entomologist, 1 athologist *Uganda* – Total 4 (at least 1 female): 1 Common bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + 4 National Project Managers Total = 24	Technical Advisors on crop genetic diversity, plant pathology, entomology Participatory diagnostic approach National Project Directors	
T5A	China national data processing and analysis	Training sessions on processing and analysis of PD data	2 China NSCC members (1 male + 1 female 2 Yuanyang ST members (1 male + 1 female) 2 Kunming ST members (1 male + 1 female) 2 Zhongdian ST members (1 male + 1 female) 2 Menghai ST members (1 male + 1 female) 2 Qionglai ST members (1 male + 1 female) 2 Meitan ST members (1 male + 1 female) Total: 14 (7 male +7 female)	Chinese people trained in T4 1 Rice GD, 1 Barley GD, 1 Faba bean GD, 1 Maize GD, 1 Entomologist, 1 Pathologist + National Project Coordinator	
T5B	Ecuador national data processing and analysis	Training sessions on processing and analysis of PD data	2 Ecuador NSCC members (1 male and 1 female) 2 Carchi ST members (1 male + 1 female) 2 Imbabura ST members (1 male + 1 female) 2 Bolivar ST members (1 male + 1 female) 2 Cañar ST members (1 male + 1 female) 2 Loja ST members (1 male + 1 female) 2 Manabi ST members (1 male + 1 female) Total: 14 (7 male +7 female)	Ecuador people trained in T4 1 Maize GD, 1 Common bean GD, 1 Faba bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + National Project Coordinator	

M/T/F[1]	Training/meeting	Module content	Participants	Facilitators	Timing
T5C	Morocco national data processing and analysis	Training sessions on processing and analysis of PD data	2 Morocco NSCC members (1 male and 1 female) 2 Ourtzagh ST members (1 male + 1 female) 2 Ghafsai ST members (1 male + 1 female) 2 Tissa ST members (1 male + 1 female) 2 Oued Amlil ST members (1 male + 1 female) Total: 10 (5 male + 5 female)	Morocco people trained in T4: 1 Barley GD, 1 Faba bean GD, 1 Entomologist, 1 Pathologist + National Project Coordinator	
T5D	Uganda national data processing and analysis	Training sessions on processing and analysis of PD data	2 Uganda NSCC members (1 male and 1 female) 2 Bushenyi ST members (1 male + 1 female) 2 Luwero ST members (1 male + 1 female) Total: 6 (3 male + 3 female)	Uganda people trained in T4: 1 Common bean GD, 1 *Musa* GD, 1 Entomologist, 1 Pathologist + National Project Coordinator	
F2		Data processing by site teams	Site teams	National SCC training participants	
F3		Data analysis by site teams and report	Site teams	National SCC training participants	
F4		National data analysis – comparison of site data; analysis across sites	National Site Coordination Committee	National Project Director	
F5		Individual surveys (30 male and 30 female per crop per partner village)	Site teams		
T6		Conduct technical assessment – crop variety sample collection at household level	Site teams + national site committee experts for each crop (if the crop is located in that partner village) and pathologist and entomologist		
F5		Global Data Analysis – analysis across sites			

6. Review of secondary data

The first step in reviewing secondary data is to produce a data checklist of information sources that should be consulted before the development of focus group discussion instructions, household surveys and technical assessment. Again the data checklist should be organized according to the guide questions. Some examples of secondary data sets and sources are listed below.

Examples of secondary data sets and sources (NOTE: only examples are given; specific references by country are to be inserted[1])

Guide question	Data set	Data source
Theme 1: Landrace identification and characterization *(includes farmer and researcher characterization of traits and genetic diversity of local varieties)* Theme 1a: Community level Theme 1b: Farm level	Genebank characterization data for maize of varieties found in project sites in Ecuador	Genebank data from Ecuador national genebank; CIMMYT genebank data information system and the CGIAR System-wide Genetic Resources Information System (SINGER)
	Quantification of faba bean richness and evenness of landraces in project sites in Morocco	Sadiki *et al.* 2003 Technical reports, SDC Global On-farm Project
	Quantification of banana diversity in Uganda	IDRC project report 2004 Rome diversity meeting report
Theme 2: General perceptions of pests and diseases *(includes farmers' perceptions and experimental documentation)*		
Theme 3: Knowledge of pathogen and pest variation *(includes farmers' knowledge and biotype variation from experimentation)*		
Does the population structure of pests and pathogens vary across systems and in space?		

[1] List of relevant national and international publications are included in the references

Guide question	Data set	Data source
Theme 4: Link between pests and diseases and intraspecific diversity (*includes farmer knowledge and experimental information on host resistance and diversity and field resistance)* *Host diversity – among and within traditional crop cultivars what genetic variation for resistance exists against the pathogen populations they harbour?* *Diversity and field resistance – does the resistance diversity present in a crop actually reduce pest and disease pressure and vulnerability, at least in the short term?* Theme 4a: Diversity of resistance of local varieties Theme 4b: Changes in diversity over time and space Theme 4c: Distribution		
Theme 5: Practices for managing pests and diseases Theme 5a: General practices Theme 5b: Management of pests and diseases with intraspecific diversity Theme 5c: Spatial arrangement of varieties Theme 5d: Selection for resistance		
Theme 6: Farmers' access to intraspecific diversity to manage pests and diseases		
Theme 7: Pest and disease movement and transmission		
Theme 8: Building on farmers' and researchers' knowledge and practices		

7. Guidelines for collection of participatory diagnostic data (FGD; community level; individual surveys)

7.1. Guidelines for collection of FGD data

The main purpose of the focus group discussion (FGD) is to explore and understand farmers' knowledge, perceptions, beliefs and practices. It is an opportunity for the research team to listen and learn, and not to lecture or provide team members' interpretation of the local biophysical and social system.

I. Designing the FGD

- A team with at least two members agree on various task assignments including: (a) facilitator/interpreter, (b) rapporteur, (c) logistics in-charge.
- Develop an FGD-PRA guide based on the pre-identified guide questions. Refer to Chapter 3, section 3.1.
- Depending on the type of data to be collected, the FGD-PRA may consist of (1) group interview methods, and (2) PRA methods which are more suitable for generating particular data.

II. Developing the FGD-PRA guide

- The guide outlines the session structure, data set and methods. Follow a simple format that is easy for the team to use. Refer to guidelines of this Chapter, section 7.1.1.
- Based on the FGD guide, a set of task guides will be developed. The task guides correspond to sections in the FGD guide, providing specific procedures and instructions (e.g. exercises, documentation).
- For each guide question, indicate the method to be used. When using PRA tools, provide descriptions/instructions.
- Use questions as a guide and check, but adapt to flow of discussion.
- Devote time to prepare and pre-test the FGD-PRA guide.

III. Arranging logistics

- Choose an FGD venue where the atmosphere is less formal, and preferably close to the field to have direct visual reference during the discussion. Minimize distractions, such as noise from passing vehicles and mobile phone calls.
- Each team member must have a copy of the FGD-PRA guide. The list of themes to be discussed may be written on the board to serve as a guide for participants on the scope and progress of the discussion.

- Prepare supplies and materials in advance (e.g. meta-cards, pens, writing boards). Inform participants in advance if the FGD-PRA session requires that they bring with them specimens from their farms (e.g. samples of diseased plants).

IV. Facilitating the session

- Begin by introducing participants and facilitators, then provide an overview of the FGD-PRA session.
- Familiarize yourself with local terminologies/names to avoid misunderstanding of what farmers say.
- Keep an open mind and listen. Do not push your own agenda (e.g. a new variety you have developed which you think will solve farmers' problems).
- Make the farmers feel that you are truly interested in learning about what they think and do with regard to the topic at hand.
- Be conversational. The FGD-PRA is a form of directed storytelling where you probe and pursue issues that arise during the conversation.
- Empathize. Try to be on equal footing with farmers in order to establish rapport and build trust.
- Although you have more expertise, never engage the farmers in a debate or pass judgement on their views or practices. Always remember your objective in talking to the farmers – to learn what they are doing, find out their problems, identify the root causes, and perhaps explore how your own knowledge could find a way into the management and decision-making about their agricultural system.
- Avoid questions that yield Yes or No answers.
- Avoid leading questions. Examples: 'Don't you think that variety X is an excellent variety?'
- Be sensitive to local norms and customs.
- Remember that farmers' time is valuable to them. Strive to complete the FGD within the time period that you mentioned to participants.
- Do not forget to thank participants and local leaders after completion of the FGD.

V. Documenting the FGD-PRA process and outputs

- The project team needs to assign 1–2 rapporteurs to record the FGD-PRA process and outcomes. Specific documentation tasks could be assigned to different project team members, e.g. background information on participants, notes on the discussion, and observations on non-verbal communication.
- Document the profile of the participants. Record names and basic demographic information.

- While the FGD relies mainly on oral discussion, the facilitator (or another team member) could write key points on the board for everyone to keep track of progress and outputs.
- The basic documentation of a FGD are the notes recorded by assigned rapporteurs, preferably organized by discussion themes.
- Since FGD data are mainly qualitative, participants' responses may be analyzed according to themes and by seeking to establish any of the following: trends, categories, typologies, concepts and definitions, reasons and explanations, identification of actors and groups, relationships and processes.
- Some quantitative data may be generated through the PRA methods used. Rapporteurs need to collect and/or record the outputs of PRA exercises.
- Data from each FGD-PRA session or exercise are treated as a single unit of observation. Comparative analysis is possible across groups within a FGD-PRA session, and across FGD-PRA sessions.
- The project team meets immediately or a day after the FGD activity. The rapporteurs consolidate the records and share these with the team. During the discussion meeting, the project team analyzes the data by grouping them according to the key themes.
- Following the meeting, a FGD report is prepared which will become part of the project's general database.

FGD-PRA Guide (sample)

Date and Location: ______________________________

FGD Team: ___________________________________

1. Purpose of the FGD (approximate time)

2. Introduction of Participants and Facilitators (approximate time)

3. Discussion Themes

Theme 1: Landrace identification and characterization (30 min)
Task 1 (Farmers' knowledge of landraces in their village): Specimen collection, matrix ranking, diagramming and group discussion for questions 1a.2, 1a.3, 1a.4 (refer to Chapter 3, section 3.1, Theme 1)
Task 2 : ...

7.1.1. Task Guide – Landrace diversity at village level

Task Guide 7-1:

Topic: Landrace diversity at village level (Questions 1a.1 to 1a.8)

Facilitator addresses group:

1. Before this meeting, we asked that you bring samples of the different varieties of [name crop] that you grow this season. Let us put them on this side of the room so we can all see these. Group these samples according to variety, and put a label on each. If you see that another farmer has brought a variety similar to yours, group them together.

2. If you call this variety by a name that is different from the label provided by other farmers, also write the name you use on a sheet of paper and put it next to the group of samples.

Facilitator: Give time for participants to examine all samples being displayed. Encourage them to discuss with other participants in order to agree on how to group the samples according to variety, and also on possible multiple names given to the same variety.

3. I would like to ask for one farmer to volunteer for each of these varieties.

Facilitator: Each volunteer farmer is asked to come forward and stand behind the assigned variety sample.

4. We now ask each of our volunteer farmers to tell us whether the variety is local or introduced/modern. If you have questions or disagree with the volunteer farmer, feel free to speak.

Facilitator: The volunteer farmer states whether his/her assigned variety is local or introduced/modern. Give time for questions/discussions until there is consensus on how to classify the variety. Then put another label on the sample, using different coloured papers for local or introduced/modern.

5. Now we are interested in knowing how to distinguish varieties from each other. First, tell us what criteria you use to compare varieties. Then, we will ask you to compare the varieties according to these criteria.

Facilitator: Construct a matrix on a large sheet of paper. On the first column, list the names of vatieties. Then write each criterion mentioned by farmers on the next columns. Do this by asking each volunteer *farmer from point 3 to list the criteria they use to describe the varieties that they have volunteered to represent. Give time for the whole group to come to a concensus on the descriptions. If there is not a concensus on traits that describe a particular variety list the variety twice as XXX variety A and XXX variety B in two separate rows and fill in the different descriptions by column for each.*

Name	Criterion

6. Do you know other varieties grown in your village/community but for which we do not have samples right here? If Yes, what are the names of these?
   Facilitator: Add the names at the bottom of the paper with a heading 'Other varieties currently grown'.

7. Do you know other varieties that are no longer cultivated in your village/community? If Yes, what are the names of these? Why are they no longer grown?
   Facilitator: Add the names at the bottom of the paper with a heading 'Varieties no longer grown'. Next to the name, write the reason(s) why they are no longer grown.

8. Are there particular people in your village who are known to have many different varieties? Who?
   Rapporteur: Note the names of these people, as well as instructions on how to locate them or their homes. They will also be used as key informants (see Section 7.2 Guidelines for community-level data).

7.1.2. Task Guide – Farmer knowledge of pests and diseases

Task Guide 7-2:

Topic: Farmers' knowledge of pests and diseases (Questions 2.1 to 2.10)

Facilitator:

1. Before the meeting we asked that you bring some examples of healthy and non-healthy [crop name]. On this side of the room, please put the healthy plants and on the other side put the non-healthy plants.

Facilitator: Let participants come forward and make two piles of the plant specimen. Put label 'healthy' or 'non-healthy' in each pile.

2. We would like to know why you consider these plants as healthy and non-healthy. Let's look at the first group; why do you consider these as healthy plants?

Rapporteur: List the characteristics of healthy plants enumerated by participants (data for Q2.1).

3. Now, for the group of non-healthy plants, divide them further into two groups. Form one group of those caused by pests and diseases, and another group of those caused by other factors.

Facilitator: Let participants divide the 'non-healthy plants' into two piles.

For this first group, describe to us how you know these are caused by pests and diseases.

Rapporteur: List the characteristics of 'non-healthy plants caused by pests and diseases', as enumerated by participants (data for Q2.3).

4. Now for this group of non-healthy plants caused by pests and diseases, group them further according to the disease and pest that caused them to be non-healthy.

Facilitator: Let participants divide the 'non-healthy plants caused by pests and diseases' into several piles of individual pests and diseases.

5. What are the names or descriptions that you can tell us for each of these diseases or pests?

Facilitator: Label each pile with the name or description provided by participants.

Rapporteur: On a large sheet of paper displayed in front, list the diseases and pests identified by participants based on the groups of specimen (data for Q2.5).

6. Besides these in the list, are there other diseases and pests of [name of crop] in your village that you know?

Rapporteur: Add names of other pests and diseases identified by participants (data for Q2.5). Then draw additional columns, parallel to the list of pest/disease names, to indicate plant parts affected (e.g. leaves, roots and stems).

Pest/disease	Plant parts affected (examples only – farmers may indicate other parts)			
	Ex. Leaves	*Ex. Roots*	*Ex. Stems*	Other
1.				
2.				
3.				

7. Now for each pest and disease, which part of the plant is usually affected?

Rapporteur: For each disease/pest name, put an X mark in the column(s) of plant part(s) affected (data for Q2.8).

8. Now tell us at what stage of growth is the plant affected.

Facilitator: Begin by asking farmers to identify what they consider as key stages of growth. These stages will determine the columns for the matrix.

Rapporteur: Draw additional columns to indicate stages of plant growth as identified by participants (e.g. germination, flowering, harvesting). Alternatively, prepare a separate sheet for these columns. For each disease/pest name, mark the column(s) of plant growth (data for Q2.9).

Pest/disease	Stages of plant growth (examples)				
	Ex. Seed	*Ex. Seedling*	*Ex. Flowering*	*Ex. Harvesting*	Other
1.					
2.					
3.					

Facilitator: At this point, show the photos of common pests and diseases of the [name of the crop].

9. Please take a look at these photographs to see if you have these other pests and diseases in your [name of crop]. If so, what names do you give to these pests and diseases?

Rapporteur: Add names of other pests and diseases identified by participants to the matrix/matrices prepared earlier (data for Q2.5).

For these additional pests and diseases, tell us the plant part(s) affected and the growth stage(s) during which the plants are affected.

Rapporteur: Mark columns of plant parts and growth stages as mentioned by participants (data for Q2.8).

10. Since we have identified the pests and diseases affecting your [name of crop], let us identify the damage caused by them.

Facilitator: Begin by asking farmers to identify types of damage. These types of damage will determine the columns for the matrix.

Rapporteur: Transfer the list of pests and diseases to another large sheet displayed in front. Draw columns based on types of damage caused.

Pest/disease	Types of damage (examples)			
	Yield loss	Fruit shape	Seed size	Other
1.	1	3		
2.	3	2		
3.	2	1		

Now let's look at the first type of damage (e.g. yield loss). Rank the pests and diseases according to the extent of damage caused.

Facilitator: Participants can opt not to assign ranks to all diseases, if these are considered as causing insignificant damage. After ranking the first type of damage, move to the other columns.

Rapporteur: For each type of damage, write the rank assigned by participants to individual pests/diseases (data for Q2.2).

11. On the whole, how do you rank the importance of these pests and diseases based on the damage caused to the crop?

Rapporteur: Draw another column labelled 'Overall importance', then write the rank given by participants (data for Q2.2).

Note: Overall importance should be based on farmers' perception of overall damage and not based on adding up the 'types of damage' *columns. The facilitator should then examine if there are inconsistencies between farmer perception and overall damage calculated by adding up values in the column. In case of inconsistencies ask the farmers why there is a difference. This may result in addition of a new column of damage type.*

Pest/disease	Types of damage (examples)				Overall importance of pest/diseases
	Yield loss	Seed size	Fruit shape	Others	
1.					1
2.					3
3.					2

12. Even if plants are diseased, do you still use them? Can you tell us how and why?

Rapporteur: List the uses of diseased plants as enumerated by participants (data for Q2.10).

13. Finally, we would like you to tell us where you think these pests/ diseases come from. We will ask you to work in small groups [pairs] and make a drawing of a disease or pest. Draw a plant and illustrate the factors that cause the pest/disease.

Facilitator: Divide participants into groups corresponding to the number of pests and diseases. Depending on the number, each group can make a drawing of 1 or 2 pests/diseases. Discuss with participants which group draws which pests/diseases. Give a large sheet and pens to each. Ask them to draw a plant and through various symbols indicate where pests/diseases come from. Let a representative from each group present and explain the drawing. In cases where participants are not comfortable in making the drawings themselves (1) facilitators can be assigned to assist in the drawing, or (2) indigenous materials can be used to construct models instead of drawing.

Rapporteur: Note the key points mentioned as participants explain the drawing. Collect the drawings and/or take a photo of the models. Ensure that the drawings/models include a guide to the symbols used. Cross-reference them to your written notes (data for Q2.4).

7.1.3. Task Guide – Assessing resistance of varieties

Task Guide 7-3:

Topic: Assessing resistance of varieties (Questions 4a.1 to 4a.4)

Facilitator to group:

1. What are the key characteristics of a resistant variety?
   Facilitator: Write each characteristic on a card and display on the board (data for Q4a.3).

2. Now we would like you to group these characteristics in terms of the stages in the crop production cycle.
   Facilitator: Let participants group the cards and label the groups, e.g. seedling, field establishment, post-harvest, etc. (data for Q4a.1).

3. Please rate the degree of resistance of each variety during different stages in the crop production cycle.
   Facilitator: Give participants some seeds. Tell them to rate degree of resistance of each variety using matrix scoring: 1–no resistance, 2–low resistance, 3–medium resistance, 4–high resistance. Ask them to place the seed on top of the cell that corresponds to the variety name and the stage in the crop production cycle (data for Q4a.1).

   Rapporteur: Make a matrix on a large sheet of paper (see below) and place on the ground. Alternatively, draw a matrix on the ground. Count the seeds placed by participants in each cell, and indicate the total in the rightmost column (data for Q4a.2). At the bottom of each column put the cards with the key characteristics of a resistant variety.

Variety	Resistance during stages in crop production				Overall resistance
	Seed	Seedling	Post-harvest	Etc.	
Variety name A	@		@@@		
Variety name B	@@	@			
Groups of cards from Step 1 and 2 with key traits of resistant varieties put at the bottom of each column	(example) Hard seeds	(example) Fast growing; Small leaves			

4. From the list of varieties you made earlier, are there any other varieties you know about that are tolerant or resistant to pest and disease attacks?

Facilitator: If response is Yes, ask participants to identify these varieties. Write the names on cards and add to table above. Then for each variety, again put in resistance levels and key characteristics of resistance.

5. We now have a list of varieties (from Task Guide 7-1) and a list of pests and diseases (from Task Guide 7-2). For each variety name and each pest disease name put a check where you think there is resistance

Rapporteur: Take notes if farmers bring in other descriptions of how the varieties differ in resistance to different pest and diseases.

Variety names	Pest/disease 1	Pest/disease 2	Pest/disease 3	Etc.
Variety A				
Variety B				

6. Have any of these varieties become more or less resistant over time? Why do you think this is?

Rapporteur: Add two more columns to the above table and mark varieties which have changed in resistance over time. Put a '+' if a variety has become more resistant and a '-' if less resistant.

Variety names	Pest/disease 1	Pest/disease 2	Pest/disease 3	Etc.	Change in resistance (+ or -)	Why?
Variety A						
Variety B						

7. How do you compare the resistance of selected or certified varieties vs. traditional/local varieties? (data for Q5d.1)

Facilitator: Write responses on individual cards. Responses would reveal criteria that participants use for making comparisons.

Criteria that emerge may include types of pests/diseases, stages of plant growth, growing conditions. Group the cards according to these criteria. Write each criterion on a card and post on top of the corresponding group of cards. Read aloud to participants and ask them to confirm that these are the key criteria.

7.1.4. Task Guide – Practices that use intraspecific diversity

Task Guide 7-4:

Topic: Practices that use intraspecific diversity (Questions 5a.1, 5c.1, 5c2, 5c.4, 5d.1, 5d.2, 5d.4)

Facilitator to group:

1. What practices do you use to manage your crops for pests and diseases?

Facilitator: Write each practice on a card and display on the board (data for Q5a.1). Participants are expected to enumerate a wide range of practices. If there is a card that says pesticide use, go to Step 2, otherwise, sort out which practices involve using intraspecific diversity (Step 3 below) and concentrate the remaining questions on practices that use intraspecific diversity.

Note: Practices that use intraspecific diversity can be categorized into (a) planting diverse varieties of the same crop together or spatial arrangement of varieties (Step 3 and 4), (b) selection of particular varieties for resistance (Step 5), (c) selection of resistant plants within a population for which seeds will be taken for the next planting (Step 6), (d) selection of seeds.

2. Have you had to increase or decrease your pesticide use over the last 10 years? Do you know why?

Rapporteur: Write down the reasons farmers believe they have had to increase or decrease pesticide use on cards.

Facilitator: This information will be used to create belief statements for individual survey Question 7.

3. Do you grow different varieties of a crop together? (data for Q5c.1, Q5c.2).

Facilitator: If participants answer Yes, ask 2a 'What are the reasons for following this practice?' If participants cite pest/disease management as a reason, write this practice on another card and add to the cards in Step 1. If participants answer No, ask 2a 'Why not?' Proceed to step 4.

Rapporteur: Record participants' 2a responses on why this practice is not used.

4. In your experience, how were the different varieties arranged? (data for Q5c.4)

Rapporteur: Give a large sheet of paper and coloured pens to each volunteer. Let them draw the crop mixtures based on previous year's experience.

Facilitator: Ask two volunteers to make a diagram of crop mixtures. Let the group choose one volunteer who cultivates a 'large' farm plot and another who cultivates a 'small' farm plot. Display the drawings, and encourage other farmers to ask questions to help the volunteers improve their drawings (e.g. adding more symbols/legends).

5. Within a plot grown to one variety, do you also perform selection of plants? For what purpose? How do you perform the selection? (data for Q5d.4)

Facilitator: Ask the two follow-up questions only if participants answer 'Yes' to the first question.

Rapporteur: Record responses to the two follow-up questions. These responses guide the specific questions to be asked in the individual interview.

6. Do you use any special method to select good seed or planting material for the next planting season from your harvest?

Facilitator: Write each method on a card and display for farmer. Then ask whether any of these practices are used for a specific variety or for all varieties and if so add a card with the name of the variety to the method.

7.1.5. Task Guide – Seed sources

Task Guide 7-5:

Topic: Seed systems (diagramming) (Questions 6.1 to 7.3)

Facilitator: On a large sheet of paper, draw squares representing the individuals participating in the FGD. These squares are arranged in a big circle around the sheet of paper. Inside every square, write the name of one participant. Then post the paper in front for everyone to see.

Facilitator to group:

1. On this sheet of paper, we have drawn squares and assigned one to each of you. First, tell us how much seed has each of you used this season?
   Facilitator: Write the amount inside the square.

2. Now for each of you, tell us where you obtained this seed. Come forward and draw circles around your assigned square to indicate your sources of seed. Draw an arrow from that circle to your square.

3. If any participant from this group is your seed source, draw an arrow pointing from his/her square to yours.

4. If you have been a seed source to any farmer in this community, draw an arrow from your square to the other square or circle representing that farmer.

5. Do you or anyone else in the community sell/distribute/exchange seeds to farmers in the community? Mark the square or circle with a large asterisk.
   Facilitator: Give participants adequate time to complete each step. If possible, use a very large sheet to make it easier for participants to write and draw directly on these.

7.1.6. Task Guide – Seed storage and seed cleaning

Task Guide 7-6:

Topic: Seed storage and seed cleaning (Questions 7.7, 7.8)

Facilitator to group:

1. We would like to know if you encounter pest and disease problems storing your seeds.

2. If Yes, describe the types of damage that these pests and disease cause to your seeds.
   Facilitator: Write the types of damage mentioned by participants on small cards and post on the board. Then ask participants to group the cards into similar types of damage.

3. What precautions do you take in storing your seeds to avoid pest and disease damage?
   Facilitator: Probe to ask for specific descriptions/general procedure for each of these precautionary practices. If participants do not mention any of the following practices, then proceed with the next question.

4. Do you practise any of the following during storage to protect from pest and disease damage—selection, cleaning, treatment of storage area? If Yes, what methods do you use?
   Facilitator: In the first column, write the practices mentioned above. Then at the top of the second and third columns, write 'How' the method is applied and 'When' you perform the practice (under what conditions, i.e. dry years, always, beginning of the storage time; when you see a lot of damage in the stored seed/plants). Fill in each column as participants discuss the methods and criteria used for each practice.

5. Are there any of these methods that you use for specific varieties? What practices and for which varieties?
   Facilitator: If participants answer 'Yes' to the first question, add a new column named 'Varieties' to the matrix in step 4. Write the variety-specific practices by writing the name of the variety parallel to the listed practice(s).

7.1.7. Task Guide – Adoption of practices

Task Guide 7-7:

Topic: Adoption or practices
(Questions 8.1 to 8.5)

Facilitator to group:

1. In what ways can the control of pests and diseases be improved in your community?

   Facilitator: Write these methods on individual cards and post them on the board. Attach to each sheet two coloured pens (e.g. blue and red).

3a. Let us know which of these practices you are using now, would continue to use and would advise others to use.

3b. Which practices you are not using but would like to use are

   Facilitator: For each card, ask each farmer to put a blue check mark for the practices they are using, would continue to use and would advise others to use; put a red check mark for the practices they would like to use.

   Rapporteur: Count the total number of blue and red marks for each card.

4. Finally, are there other practices that you think should be avoided because these do not help control pests and diseases?

7.2. Guidelines for community-level data

The community-level assessment targets data that are appropriately collected and analyzed at the level of the village. It is undertaken with the participation of a purposively selected group of key informants. For each village, one group of key informants conducts a community-level assessment together with facilitators from the project team.

During the FGD sessions, participants are asked to identify key informants to be involved in a subsequent community-level assessment. Each of the 5 FGD groups per village nominates 2 representatives to compose an assessment group of 10 members representing the diversity of the FGD groups.

In a village with two focus crops, only one representative is nominated per group. Based on a total of 10 FGD groups for the 2 crops, the assessment group consists of 10 members.

7.2.1. Transect mapping (background biophysical data on the village)

Overview: The purpose of transect mapping is to construct a visual representation of how local people identify the various agroecological zones comprising the village. The assessment group conducts a community walk across the village, following a path that traverses the topographic profile of the area.

Instruction to the Facilitator: Prior to the scheduled exercise, consult with the group as to which particular location local people consider the highest elevation in the village. Invite the group to assemble at this location at a designated date and time.

Prior to starting the transect walk, allow group members to reach consensus on (1) which location in the village is the lowest elevation and (2) which route from the highest to the lowest elevation enables them to directly observe the diverse biophysical characteristics of the village.

During the walk, instruct participants to note distinct characteristics (e.g. topography, soil and other natural resources, vegetation and land uses) for particular areas of the village. Allow farmers to stop at particular locations to inspect these characteristics, to collect specimens and to discuss any significant observations anyone makes. The entire walk may take approximately 1–2 hours depending on the distance covered.

Upon completion of the transect walk, gather participants in a nearby house or shaded area for the mapping exercise. Explain that the purpose of the exercise is to draw a transect map representing the agroecological zones comprising the village.

Begin with a discussion through the following guide question: *If you were to categorize the village according to key biophysical features, what would these categories be?*

Provide the group with a large sheet of paper and coloured pens. From the left to the right side of the paper, let them draw a line to illustrate the topographic profile (e.g. variations in elevation, slope) of the village. Then ask them to mark the agroecological zones through vertical lines. For each zone, participants then draw symbols on the topmost row to represent major physical features (e.g. land-use types). On the next row, participants identify the common crops and livestock found in each zone. Names may be written or be represented by symbols. Then on the lowest row, participants list the key problems or constraints for managing the physical and biological resources in each zone.

Output: A transect map is generated through the above exercise, jointly drawn by group members following the visual observation and discussion.

7.2.2. Crop mapping

Overview: The purpose of crop mapping is to locate areas in the village where the target crop is [crops are] grown, and what varieties are grown in each area planted to the crop(s). For this project the objective is to get an idea of the total area in each community devoted to each crop.

Instruction to the Facilitator: Explain the purpose of this next mapping exercise, as stated above. Give participants another large sheet of paper along with coloured pens. Emphasize that it is important for the group to agree on a common set of colours/symbols to represent different crops and varieties.

Begin the exercise by asking the group to draw lines forming a shape that demarcates the physical boundaries of the village. Ask participants: *Which areas of the village are used for crop production, and what crops are grown in each area?*

Use the current season as a reference point, or the immediate past season if the exercise is done after crop harvest. Participants mark areas on the paper using coloured pens to distinguish the crops grown. Encourage them to mark areas on the map that approximate the relative size of the actual crop areas.

The next step is to identify varieties used in each area planted to a crop. Ask participants: *Now that we know where particular crops are grown, what varieties are used for each crop area?* Participants start working on one crop area, using different symbols (e.g. asterisks, circles) to mark the composite areas covered by different varieties. Again, encourage them to assign areas on the map that approximate the relative size of the actual areas covered by these varieties.

At the bottom part of the paper, ask participants to write down notes as a guide to the colours and symbols used.

Output: A crop-variety map of the village is generated through the above exercise, jointly drawn by group members following the visual observation and discussion.

7.2.3. Key informant interviews

Overview: The purpose of key informant interviews is to discuss and validate the key findings from the FGD sessions. This elicits additional explanatory data from informants who are recognized in the community for their knowledge of the crop and its local context. Individual members of the assessment group comprise these key informants.

Three types of key informants are envisioned for participatory diagnostics.

i) Farmers who manage a high diversity of crop varieties
ii) Farmers who are known to buy and sell or exchange seeds from the partner villages
iii) Farmers who are known to have knowledge on pest and disease management.

Instruction to the Facilitator: Prior to this exercise, the project team had (1) conducted a preliminary analysis of the FGD outputs and (2) prepared a checklist of discussion points/guide questions for the key informant interview. This checklist consists of specific findings from the FGD which the team selected because it considers these as requiring further probing. It may address data gaps, inconsistencies or inadequate documentation.

The checklist is expected to consist of questions which are generally of the open-ended type. Examples:

1. The research team has found the following findings to be inconsistent/contradictory (identify these findings). Could you explain these further to help the team better understand these findings?
2. The research team considers the following findings to be especially interesting/significant, but we were not able to ask FGD participants to explain them to us (identify the findings). Could you provide more details to help the team better understand these findings?

3. The research team is unfamiliar with the following terms/labels/statements that FGD participants mentioned. Could you explain them to help the research team better understand what these mean?
4. Do you have any specific/general comments on the FGD outputs? Could you share these with the research team to help derive appropriate conclusions/recommendations?

The three sets of informants, with their distinct areas of expertise/knowledge, are expected to provide different but collectively useful inputs.

As a first step, divide key informants to form a group for each focus crop (i.e. in the case of a village with two or more focus crops). Then assign a set of items in the pre-designed checklist/crop to each key informant. In this way, interviews can be done simultaneously with individual informants, each of them covering a different set of items. This also requires multiple facilitators, corresponding to the number of informants.

Ensure that copies of the FGD reports, as well as the outputs/raw data, are available as you conduct the interview. The facilitator and key informant may wish to refer to these in the course of the interview.

Responses of the key informant are directly recorded on spaces provided after each question in the checklist.

Output: Responses from key informants written after each question in the checklist(s) for each focus crop. These sheets are compiled by crop, and serve as sources of raw data for the key informant interview. These data are used to finalize the FGD reports, as well as to refine the questionnaire for the subsequent individual interviews.

7.3. Guidelines for individual interviews

I. Developing the questionnaire

- Make use of the results from the FGD session in formulating interview questions. Refer to Chapter 7, section 7.1.2 to 7.1.8 and 7.2.2.
- Interview questions may be formulated as (1) closed-ended or fixed alternative, (2) open-ended, (3) scale. Where appropriate, belief statements can be used.
- Avoid the following: leading questions, double-barrelled questions, embarrassing questions and negative questions.
- Make sure questions are clear.
- Do not use technical or scientific jargon that respondents may not understand.
- When a general question and a related specific question are to be asked together, ask the general question first.
- Organize the questionnaire in some logical sequence. Group together items that use the same response options or categories.
- Provide brief, clear instructions to the interviewer.

II. Refining the questionnaire

- Translate the questionnaire into the language to be used in the actual interview.
- Note that the instruments will be more precise if a question is read in the same language in which it is written.
- Pre-test the instrument by interviewing a small group of respondents, to determine their reactions to the draft questionnaire.

III. For the interviewer: conducting the interview

- Be friendly, courteous and conversational.
- Ask each question exactly as it is worded in the questionnaire.
- Be extremely careful not to suggest a possible reply.
- Never show that the respondent is wrong when asking questions about their knowledge.
- Ask questions in the same order as they appear on the questionnaire.
- Do not let your respondent take you away from the subject.
- Never engage the farmers in a debate or pass judgement on their views or practices.

IV. Processing interview responses and data analysis

- Write down responses accurately.

- Edit responses to facilitate data processing and analysis.
- At the end of the interview, check if responses are complete before moving to the next respondent.
- Encode responses to a database (e.g. spreadsheet) using a coding guide.
- Data analysis may consist of scoring scale responses, frequency distributions, computation of indices, attitude/beliefs, reliability analysis of scales, mean comparisons, correlations and non-parametric statistics.

7.3.1. Draft individual interview form – to be filled in for each crop

Farm mapping showing spatial distribution of varieties among and within plots. (Q1b.3)

1. We would like to understand the distribution of varieties among and within plots

   Note to the interviewer: ask farmer to draw a farm map showing: boundaries and area of his/her land, and marking this according to how he/she divides the farm into plots (write the plot name or label if applicable).

   Ask farmer to give: a) total area of his/her farm (write this on the top part of the paper), and b) area of each plot (write inside each box representing the plot).

   For each plot, the farmer identifies the crop/s planted for the current season -- labelled by name, symbol and/or divided into sub-plots. Then, ask what varieties of the crop are grown for each plot/sub-plot, and label the names of the varieties.

   Based on this farm map, the interviewer determines which of the project's Focus Crops are grown by the farmer. For each Focus Crop, the interviewer asks the questions below. The number of times the set of questions is asked depends on the number of Focus Crops grown by the farmer-respondent.

   Note to the Rapporteur: Farmer or rapporteur can draw the map on the back side of the questionnaire paper.

2. Do you grow different varieties together in one plot? (Q5c.2)

   If so have the farmer draw how the varieties are arranged within the plot.

3. For what reasons did you arrange the different varieties within the same plot? (Use list of reasons from FGD.)

Reasons (from FGD)	Mark √
Reason 1	
Reason 2	
Reason 3	
Reason x	

Note to Rapporteur: Make a second copy of the map to be used later (see question 12 of this questionnaire).

Varieties currently grown and in the last five years (Q1b.4)

4.What varieties have you grown in your field for the last five years?
Note to interviewer: Transfer the list of varieties identified in the map to the table below.

Now let's talk about crop X (specific Focus Crop). Besides the varieties you grow this year, what other varieties have you grown in the last 5 years?

Note to interviewer: The list of varieties should include all varieties, both modern and traditional, but the focus of the rest of the information is on the potential of traditional/local varieties and diversity-rich practices.

Variety	How many years have you grown them? (Q4b.3 and feeds into Q3.1)	How often do you change seeds for these varieties?
Varieties Grown This Year (list from the information in the map)		
Var A		
Var B		
Var C		
Other Varieties Not Currently in the Field, but Grown in the Last 5 years[1]		
Var A		
Var B		
Var C		

[1] To probe for other varieties previously grown, refer to other varieties grown in the community as mentioned in FGD

Area planted to each variety and criteria used (This question answers questions 1b.5, 1b.6, 1b.7, 1b.8, 5d.2)

5. Why do you plant each variety?

From the map, you said the total area planted to crop X (Focus Crop) is ______ and that you now grow ___ varieties for this crop. What is the area planted to each variety (Column 2)? What criteria do you use in deciding the area for planting each variety? How do you rank the importance of these criteria? (Column 3 to X).

Note to interviewer: Transfer the list of varieties identified in the map (i.e. currently grown) to the table below. List criteria mentioned by farmers as headings for Columns 3 to X). Arrange the criteria from the most to the least important, as ranked by farmers.

Let's look at each of the criteria you mentioned. To which of these varieties do you allocate more area because of Criterion 1 ________? Criterion 2________? Etc.

Note to interviewer: For every criterion (Column), mark √ for those varieties mentioned by farmers.

Name of variety	Planted area (give actual area planted	Criterion1 ________	Criterion 2 ________	Criterion 3 ________	Criterion4 ________	Criterion 5 ________
Var A						
Var B						
Var C						

Diseases and damage caused.

6. What diseases have you observed during the last year (i.e. two seasons) in your farm (Column 2)?

What types of damage have these diseases caused to your crop (Columns 3 to X)? How do you rate the diseases in terms of their overall damage caused to the crop? Please score from 1 to 3 with 1-low, 2-moderate, 3-high (Last Column).

		Type of damage caused‡				
Name of pest/ disease†	Observed in the Farm	No damage	*Ex. Yield loss*	*Ex. Reduced seed quality*	*Ex. Others (from FGD)*	Overall*

Note to the Interviewer: First get the list of disease/pest names from the farmer. Then confirm with the farmer, using the photos and list of traits from FGD, to ensure the consistency of the names.
Mark with √ the type of damage the farmer cites for each disease/pest.
Ask farmers to score: 1-low, 2-moderate, 3-high

Origins of diseases/pests (Q7.1)

7. There are many belief statements about origins of diseases/pests. I have a list of them; I want to know if you agree with the following statements or not.

Note to research team: Formulate at least three belief statements for the following topic; source of belief statement is footnote in Task Guide 7.1).

- Diseases/pests come from dew.

____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

Resistance of varieties

8. How do you rank these varieties based on their susceptibility/resistance to each disease? Please score from 1 to 3 with 1-low, 2-moderate, 3-high (Columns 2 to X).

Name of variety	Varieties According by Degree of Resistance*			
	Pest/Disease 1 *Ex rice blast*	**Pest/Disease 2** *Ex. Leaf blight*	**Pest/Disease 3** *Ex. stem borer*	**Pest Disease x**
Var A				
Var B				
Var C				
Var …				

* For each disease, ask farmers to score: 1- low, 2-moderate, 3-high

Spatial differences in pest/disease damage

9. Do you usually have the same disease damage as your neighbour's field?

__Yes __No

If No, why not? (reasons from FGD):
Reason 1 ________________
Reason 2 ________________
Reason 3 ________________
Reason x ________________

10. If the same variety is planted in different plots, are there differences in disease/pest attacks between the plots?"

Note to interviewer: This question is asked only if the farm map (Q1 of this section) shows that a variety is grown in different plots.

Temporal differences in pest/disease damage

11. Have you noticed any change over time in the resistance of your varieties? Changes between dry and wet, or cold and hot years? (Questions 4b.3, 4b.4, 4b.5)

List of varieties and years grown (Choose max. 3 varieties grown the longest from table in Question 2)	Differences in resistance between dry and wet years (more resistant during dry year, more resistant during wet year, no difference)	Differences in resistance between cold and hot years (more resistant during cold year, more resistant during hot year, no difference)	Overall change in degree of resistance since the variety was first grown (increase, decrease, no change)
Var A			
Var B			
Var C			
Var …			

Information from this question could lead to key informant interviews that capture information on durability

12. Here is a copy of the map we did earlier. Please mark what crops were planted where in each plot last year. Please also put the name of each variety on the map

Note for interviewer: Use the copy of the map developed at the beginning of this individual questionnaire.

13. For what reasons did you change the crop allocation to plots? (Use list of reasons from FGD.)
Reason 1 ________________
Reason 2 ________________
Reason 3 ________________
Reason x ________________

14. For what reason did you change the variety allocation to different plots? (Use list of reasons from FGD.)
Reason 1 ________________
Reason 2 ________________
Reason 3 ________________
Reason x ________________

Use of product and control inputs (pesticides and chemical fertilizers) (Questions 5a.1, 5a.2 and 5a.3)

15. So as to determine the use of pesticides and chemical fertilizers, please give an estimate of the amounts of pesticide/chemical fertilizer used (if any) and the number of times pesticide was put in each plot this year.

Note to interviewer: Ask the farmer to look again at the farm map in order to identify the plots for the table below. For each plot where the Focus Crop is grown, ask how many applications, when and how much for each type of pesticide/fertilizer input. Mark the use of pesticide in blue and use of fertilizer in black on the copy of the map produced with question 1. The number of tables depends on the number of plots where the Focus Crop is grown.

(This assumes the interview is done towards the end of the season, to be able to estimate total amounts applied for that season).

Plot number/name:_____

Application of External Inputs	First application	Second application	Third application	X application
Pesticide				
When				
How much by type:				
-				
Fertilizer				
When				
How much by type:				
-				

Diversity management to control diseases/pests

16. There are many belief statements about diversity mangement to control diseases/pests. I have a list of them; I want to know if you agree with the following statements or not. (Questions 3.2, 4b.1, 4b.4)

Note to research team: Formulate at least three belief statements for the following topic.

Reasons why a variety becomes susceptible:

- Modern varieties become more susceptible if you grow them year after year.

____1) Strongly agree
____2) Slightly agree
____3) Undecided

____4) Slightly disagree
____5) Strongly disagree

• Local varieties do not become more susceptible if you grow them year after year (depending on disease, e.g. for blast).
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

• Varieties become susceptible if you grow them next to susceptible varieties.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

• Varieties are attacked more often by insects if you grow them year after year.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

17. Multiple varieties vs. crop vulnerability belief statements:
• If you grow only one variety you will have more insect attacks than if you grow more than one variety.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree
Crop genetic diversity to reduce pest and disease pressures on-farm 65

• Planting more than one variety per plot gives me more income from production.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

• Planting more than one variety per plot is more costly than uniform planting.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

Seed sources and flows

18. (Questions 6.1, 6.2, 6.3 and 7.3). How much seed did you get this season? Where did you get the seeds and how much from each source? Did other farmers obtain seeds from you? What problems did you have? Did any seeds give you unhealthy plants? What was the health of the seeds obtained?

Draw a circle for each variety (as per question 1) and put in the amount of seed obtained. And write the name of the variety in each circle.

Draw other circles representing the sources of each variety with arrows pointing to the first centre circle. Write the amount of seeds coming from this source.

For each source:

i. Indicate if you had any problems getting these seeds, write these next to the arrows pointing to the sources.

ii. Indicate, by circling with a red pen, if any of these seeds you obtained (and from whom) gave you unhealthy plants.

Draw squares of other farmers who obtained seeds from you, with an arrow pointing to the source. Write the amount of seeds going to each source.

Make triangles of any source of seed that you know but did not get seeds from, and mark with a dotted arrow. Write the names of these sources, inside the triangle. Write reason why you did/could not obtain seed from these sources, next to the dotted arrow.

Are there people in your village who often sell/distribute/exchange seeds to farmers in the village? If yes, who ____________? (Q7.2)

19.

What criteria do you use to choose high-quality seed? (Example of possible criteria from FGD, Q7.8)	Mark √
Ex. Select clean seeds/healthy (without marks, cuts, holes)	
Ex. Big seeds	
Ex. Full seeds	
Other	

Practices to determine which seeds will be planted the following year

20.

Are the plants to be used as seed/planting material selected from among particular plots on your farm?	Mark √	By whom	Where
Ex. A particular plot in the field, a home-garden			
Ex. Seedling bed			
Are the plants to be used as seed/planting material selected from within particular sections of the field or plot? If yes, which section	**Mark √**	**By whom**	**Where**

Plant selection

21.

Are particular plants selected to be used for seeds	Mark √	By whom	Where
Are seeds (or planting material) selected from a particular part of the plant? If yes, which part?	**Mark √**	**By whom**	**Where**
Ex. Seeds from the centre of the maize cob			
Others			
Is the plant you will take the seed/planting material from selected at a particular stage of plant growth? If Yes, at what stage?	**Mark √**	**By whom**	**When**

22.

What post harvest methods do you use to select seeds/ planting materials? (List of responses on methods come from FGD)	Mark √	By whom	How
Ex. Manual selection clean, healthy and full			
Ex. Sifting			
Ex. Traditional treatment with "Atassa"			
Others			

23. Are any of these practices related to pest and disease resistance/ tolerance?

Note: Interviewer to make circles on practices related to pest and disease resistance from Question 17a-e.

24. There are many belief statements about diversity management to control diseases/pests. I have a list of them; I want to know if you agree with the following statements or not. (Questions 7.6, 7.7, 7.8 to form belief statements).

Note to research team: Formulate at least three belief statements for the following topic from FGD.

• Farmers should use clean seeds every season to prevent pest and disease attacks.
____1) Strongly agree
____2) Slightly agree
____3) Undecided
____4) Slightly disagree
____5) Strongly disagree

25. Using the information from the FGD, which of the practices would you use and which would you not use?

Practice	Can be used to control P&D	You would advise	You would avoid
Practice 1			
Practice 2			
Practice 3			
Practice x			

8. Checklist of data and technical assessment methods

8.1. Overview of technical assessment

The project revolves around the main hypothesis that: *intra-specific diversity in farmers' fields reduces vulnerability and damage to the crop*. One of our main project outputs is, therefore, the lowering of vulnerability. It is, therefore, necessary to have methods that will allow us to demonstrate that there is less vulnerability in a project site than before, or than compared to other sites. This includes defining and measuring indicators of vulnerability (see below) and relies on three main areas of technical assessment:

- Assessment of variation for resistance among and within traditional crop cultivars We, therefore, want a sample that enables us to look at variation in resistance in host crops;
- Assessment on resistance and reduction in disease and pest damage and vulnerability. Here we need to test whether the resistance we have found is helping to reduce damage; and
- Assessment of how the variation in population structure of pests and pathogens varies over time and space. Here we are testing whether we are dealing with a variable pathogen species or pest species, and what is the nature of the variation of the pathogen or pest species.

Technical assessment will therefore include characterization of hosts, pests, pathogens and surrounding abiotic environments. For maize, faba bean and common bean, care will be taken to collect large enough seed samples to allow for screening for diversity within a sample, and to note all descriptive information by farmers. For plantain, plants will be mapped within populations/sites based on morphological and resistance traits. Initial standards for experimental design and sampling by crop will be decided upon by project partners during the first six months of the project.

Technical assessment includes protocols to determine crop vulnerability and change in pest and pathogen pressure. Crop vulnerability reflects a 'potential for damage' rather than 'actual damage.' Both vulnerability and pest pressure relate to 'interactions' between host and pest in specific environments. Both 'vulnerability' and 'change' have an inescapable time dimension that must be taken into account. Indicators of vulnerability include: actual number of varieties, or variety 'richness', 'effective' number of varieties, or 'evenness' of frequency, relatedness, or interpopulation F-coefficient, and resistance genotype diversity. Measuring pest pressure on-farm will include prevalence in an area, damage and yield loss, response to pesticide application, response of tester host genotypes of known resistance. Basic methods for this assessment are monitoring disease or pest impacts, taking samples of both host plant and pest for tests of response to local biotypes, comparing local and exotic hosts for diversity in their biotype response, and assessing diversity for traits affecting host response (e.g. morphology) and diversity for neutral markers. It should be noted that measures of genetic diversity in hosts, and of the prevalence and damage of pests or disease, are only partial indicators of vulnerability and pressure.

Pathogen variation and resistance in landrace populations can be assessed by screening samples of isolates against a range of host genotypes. This would involve samples of pathogen isolates from local landraces and samples of host genotypes from the same populations. The tests for disease response would include standard host genotypes (e.g. differential sets, modern cultivars of known resistance, universal susceptible) and tester pathotypes.

	Response to pathogen					
	Sublines from donor landrace population					**Standard host genotypes**
	1	**2**	**3**	**4**	**....**	
Isolates from local landrace						
Isolate 1						
Isolate 2						
Isolate n						
Testers or known isolates						These data include known control responses
Tester 1						
Tester 2						
Tester n						

To understand whether there is diversity in resistance in varieties planted under different environmental conditions, plot-specific information is collected, based on the individual survey data. This information is compared with farmers' information on whether there are differences in resistance when varieties are planted in different plots

Finally, focus group discussion will result in the traits that farmers use to characterize and distinguish varieties, pest and pathogens. Sampling for technical assessment host diversity will then be based on sampling local cultivars from the 60 households per target crop selected for individual interviews.

8.2. Guide questions for technical assessment

Guide question	Data set[1]	Technical assessment method
Theme 1: Landrace identification and characterization (includes farmer and researcher characterization of traits and genetic diversity of local varieties)		
Theme 1a. Community level		
1a.2 What varieties do you grow in your village and in your community?		Review of *ex situ* collections
1a.4 How are these varieties distinguished from each other?		On-farm trial (as support tool for FGD)
1a.6 Do you know other varieties that are no longer cultivated in your village/community (i.e. were cultivated before but are not now)? Why are they no longer cultivated?		Review of *ex situ* collections
Theme 1b. Farm level		
1b.3 What varieties are you growing now?		Sample collection and diversity assessment
1b.4 What varieties have you grown in your field for the last five years?		Sample collection and diversity assessment
1b.7 What proportion of each of these varieties is planted in your farm in this season?		Sample collection
Theme 2: General perceptions of pests and diseases (includes farmers' perceptions and experimental documentation)		
2.1 How do you distinguish a healthy plant from a non-healthy plant?		Sample collection, pest and disease characterization
2.2 How important are pests and diseases in affecting the health of your crop?		Site evaluation of the rate of infestation
2.5 What pests and diseases do you find in your crop? (names and descriptions of pests and diseases)		Field inspection with farmers; pest and pathogen collection, and characterization
2.6 How do you recognize the effect/damage of each one (what are the symptoms of each)?		Field identification
2.7 What are the effects of each pest disease on the crop (yield loss, others)?		Yield loss trials
Theme 3: Knowledge of pathogen and pest variation (includes farmers' knowledge and biotype variation from experimentation) **Does the population structure of pests and pathogens vary across systems and in space?**		
3.4 How much does the genetic make-up of pest and pathogen populations vary among farms and over time?		Plant variability assessment, pest and pathogen collection and characterization

Guide question	Data set[1]	Technical assessment method
Theme 4: Link between pests and diseases and intraspecific diversity (includes farmer knowledge and experimental information on host resistance and diversity and field resistance)		
Host diversity – among and within traditional crop cultivars, what genetic variation for resistance exists against the pathogen populations they harbour?		
Diversity and field resistance – does the resistance diversity present in a crop actually reduce pest and disease pressure and vulnerability, at least in the short term?		
Theme 4a. Diversity of resistance of local varieties		
4a.1 Are there differences in resistance between varieties? At what growth stage of the plant?		Assessment of resistance interaction/ epidemiology
4a.2 Are there differences in tolerance or resistance of varieties to post-harvest (storage) pests?		Assessment of plant variability
4a.4 How do the varieties differ in degree of resistance/ tolerance?		Assessment of plant variability and resistance mechanisms
Theme 4b. Changes in diversity over time and space		
4b.5 What are the reaction(s) to the pathogen of the same varieties planted in different locations or different years?		Characterization of the environment, assessment of field resistance and epidemiology
Theme 4c. Distribution		
4c.1 Within your village, how are the target crops distributed?		Satellite photography
4c.2 How do you distribute or deploy your varieties among plots (mosaics)? Why?		Plot characterization
4c.4 How do you distribute or deploy your varieties over time?		Annual sampling
Theme 5: Practices for managing pests and diseases		
5c.4 How are the varieties arranged together now? How could they be arranged?		Trials
5c.6 What is the effect of spacial arrangements on reducing pests and diseases?		Field assessment
Theme 5e. Selection for resistance		
5e.2 Are there any specific varieties you chose for tolerance or resistance to pest and disease attacks?		Plant variability assessment, and resistance interaction/epidemiology
5e.3 What criteria do you use to choose these varieties?		Plant variability assessment, and resistance interaction/epidemiology
5e.4 Within a variety, do you select? *(Note – not necessarily selection for resistance; could be indirect selection.)* Are any of these practices related to disease/tolerance?		Compare to breeder selection practices
5e.5 What criteria do you use?		Field trials
5e.6 When do you practise selection (what stage of the plant)?		Field trials
5e.7 Where do you practise selection: in the field, in the house?		Field trials
5e.8 Which part of the field or plot?		Field trials
5e.9 Which part of the plant do you select?		Field trials
5e.10 Are any of these practices related to disease/ tolerance?		Field trials

Guide question	Data set[1]	Technical assessment method
Theme 6: Farmers' access to intraspecific diversity to manage pests and diseases		
No question requires technical assessment		
Theme 7: Pest and disease movement and transmission		
7.3 Do you usually have the same disease damage as your neighbours? Why or why not?		Field visits
7.5 Do your neighbours usually get more pest/disease damage than you? Why?		Direct observation, Field observation
7.8 Do you practise selection, cleaning or screening to obtain healthy seed? Methods and criteria?		Direct observation
Theme 8: Building on farmers' knowledge and practices		
No question requires technical assessment		

[1] To be agreed upon for each crop.

9. Data processing of participatory diagnostic data

9.1. General overview

Since participatory diagnosis (PD) makes use of multiple methods, it yields diverse types and forms of data. In Chapter 7, the different categories of data that can be gathered at the community, group and individual levels are listed. These include questions that require discrete categories of responses, open-ended questions that yield qualitative data, while other tools produce visual outputs, such as maps.

In all cases the analysis of PD data requires prior processing. Its purpose is to transform raw field data—generated through various methods—into a form that facilitates systematic analysis in quantitative and qualitative ways. The goal of processing is to encode raw data into a unified database, by assigning them numerical identities and values.

The project site[1] is the primary unit of PD data processing, analysis and reporting. In other words, each Site Team (ST) establishes a database comprising the data collected from its constituent villages. The target output of data processing is therefore to produce a site-level database. The latter becomes the basis for site-level data analysis and preparation of a site-level report.

It is important to remember that the research questions and data sets are classified by crop. Therefore for each site, the total number of PD reports corresponds to the number of crops in each site. Crop-specific data at the village level are processed to comprise the crop-specific subdatabase at the site level. In turn, crop-specific reports at the site level are prepared based on these subdatabases.

Example: Number of site reports for China

Country	Site	Crop(s)	Number of site reports
China	Yuanyang	Rice	1
	Kunming	Rice, faba bean	2
	Zhongdian	Barley	1
	Menghai	Rice	1
	Qionglai	Rice, maize	2
	Meitan	Rice	1

1 See Section 4.3 for list of sites.

At the national level, the number of PD reports corresponds to the number of PD sites multiplied by the number of crops covered in each country. Site-level reports are consolidated and further analyzed at the country level. The national team is responsible for preparing a country report, which consists of crop-specific subreports, which are then discussed and shared in global/project-level reporting.

In summary, the process of data analysis and reporting involves two basic steps: (1) processing field data to develop a database and (2) analyzing the database to produce a report of participatory diagnosis.

Example: Number of national reports

Country	No. of national-level crop reports	No. of national-level synthesis reports (cross-crop comparisons)
China	4 (Rice, faba bean, barley, maize)	1
Ecuador	4 (Maize, common bean, faba bean, *Musa*)	1
Morocco	2 (Barley, faba bean)	1
Uganda	2 (*Musa*, common bean)	1
Global	6 (crops)	1 (Global level = cross-crop/cross-country comparison)

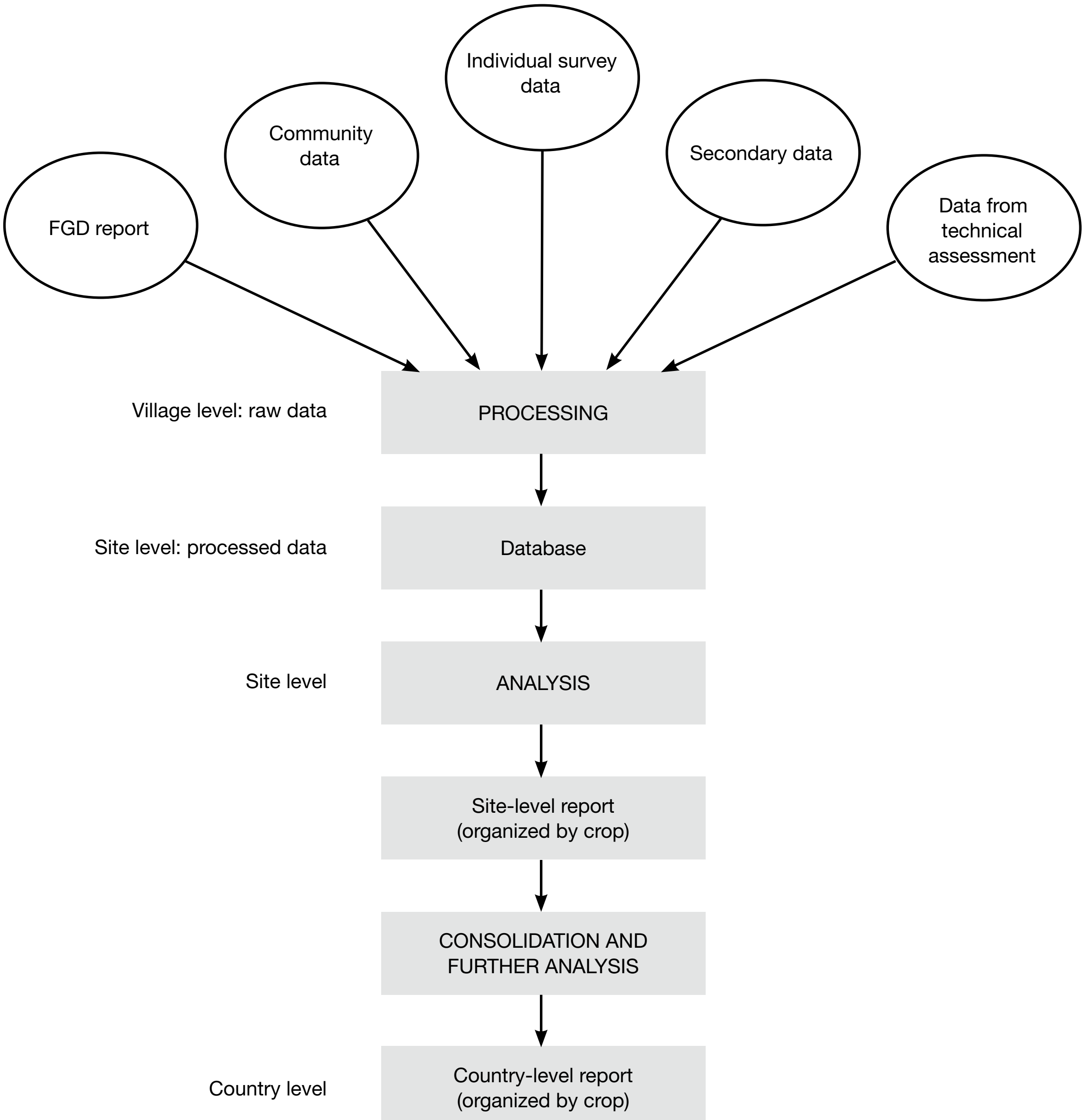
9.2. Collecting participatory diagnosis field data

The PD methods produce different types of documentary outputs.

Each FGD session constitutes one unit of observation, irrespective of the number of participants in each session. A written report documenting the FGD process and outputs is prepared for every session. The report follows the general structure of the FGD guide used for the FGD sessions. Aside from documenting the main discussion process and outputs, the report includes a basic profile (e.g. name, gender, age) of all participants.

Similarly, community mapping results in a group-level output from selected informants who provide information about the community. Each map, collectively prepared by a group of key informants, is one unit of observation. Note that for FGD and community mapping, subgroups may be formed, which produce suboutputs. For example, in an FGD, participants are divided into three groups to undertake diagramming, resulting in three diagram outputs from the same group.

Individual interviews result in a set of completed questionnaires with responses directly recorded on them. Each questionnaire is one unit of data collection or observation. Therefore, an interview



with 60 respondents produces the same number of completed questionnaires comprising the field data.

Collection of secondary data leads to a compilation of published and unpublished documents. A bibliographic list of these documents facilitates easy retrieval of relevant data.

Finally, technical assessment produces observational and experimental data which are directly generated by the research team. These data are often handled according to established technical procedures set by the relevant disciplines, e.g. pathology, entomology.

9.3. Methods of data processing

The database is structured according to the list of research themes/ guide questions earlier identified for the PD. In other words, again we go back to the original list of questions in Section 3.1.

To encode the field data into the database, a coding guide needs to be developed. This coding guide assigns numerical identities and values to raw data. For example, on the question about gender of respondents, 'male' and 'female' can be assigned codes of 1 and 2, respectively. It is essential that a comparable coding guide be used across the sites to facilitate database integration at a higher level.

The coding guide will be developed globally after the first FGD surveys are completed (see Section 5.2 for schedule).

Data processing is undertaken according to the type of raw field data collected through the various PD methods. These data are broadly classified as:

i) identification and characterization
ii) rating and comparison
iii) visualization.

9.3.1. Identification and characterization

These cover lists of names, criteria, descriptions, reasons and similar nominal data to identify and characterize a particular subject. Usually, they are generated through a 'what' question.

For example, Question 1 in the individual interview (Chapter 7, Section 7.3.1) (which corresponds to Guide question 1b.3) asks a respondent to list the varieties grown during the current season. In the FGD on farmers' knowledge of pests and diseases (corresponding to guide questions 2.1 to 2.10), participants are asked to enumerate the characteristics of healthy and non-healthy plants. A code (e.g. number) is assigned to each characteristic identified by participants from all the FGDs. This code is used to enter the data into the database. In the case of multiple responses, the coding guide needs to cover the various combinations of responses.

Characteristics of healthy plants identified by FGD participants

Coding Guide	i)	Dark green leaves
	ii)	Smooth leaf surface
	iii)	Plant is standing upright

In some cases, the responses are already numerical. These are entered into the database as such, and may not require prior coding. For example, Guide question 4b.3 asks a respondent how many years the variety has been grown. The respondent's answer is directly entered under the column that has been labelled for the variable 'number of years'.

Number of years Variety X has been grown

Respondent	Number of years
1	10
2	15
3	7

9.3.2. Rating and comparison

These include ranks, scores and similar data which require farmers to rate, compare and differentiate. To facilitate coding of this type of data, it is ideal to set the same range of scores or scales when designing the instruments for data collection.

These are commonly generated through matrix ranking and scoring tools. Numerical data are directly obtained from respondents/ informants, and are often already in tabulated form. Each table generated from an FGD session is treated as one unit of observation; similarly a matrix score from one questionnaire respondent is a single unit. An example of the former is the output of matrix scoring for the FGD on assessing resistance of varieties (corresponding to Guide questions 4a.1 to 4a.4). An example of the latter is the response to Question 3 (Section 7.3.1) on ranking the area planted to each variety (corresponding to Guide questions 1b.5 to 1b8.

Verify that the assigned codes are consistent with the actual scale used by participants during the FGD, e.g. 3 represents highest (not lowest) rating on a scale of 1 to 3.

Disease resistance of varieties as assessed by FGD groups in matrix ranking exercise

FGD group	Variety X	Variety Y	Variety Z
1	3	1	2
2	2	1	3
3	3	1	2

9.3.2.1. Belief statements

Belief statements are another type of data involving rating and comparison. Scores are assigned to each possible response on a rating scale. These represent the direction, extent or degree of agreement/conformity to particular beliefs, attitudes, norms and motivations. An example is the belief statements on crop vulnerability in question 1b.8 of the individual interview (corresponding to Guide question 5c.2). A belief index is computed based on these scores, for which statistical software such as SPSS comes in handy. These belief indices can be subsequently analyzed for reliability.

Coding for belief statements signifies the direction of the belief. In the sample statements below, 3 is the neutral belief. However, the first is a positive statement; thus a score of 5 is given to a 'strongly agree' response. Meanwhile the second is a negative statement; thus a score of 5 is given to a 'strongly disagree' response.

Coding guide for statements according to conformity to beliefs/attitudes desired by a project

Statements	Codes				
	Strongly agree	Slightly agree	Undecided	Slightly disagree	Strongly disagree
If you grow only one variety you will have more insect attack than if you grow more than one variety	5	4	3	2	1
Planting more than one variety per plot is more costly than uniform planting	1	2	3	4	5

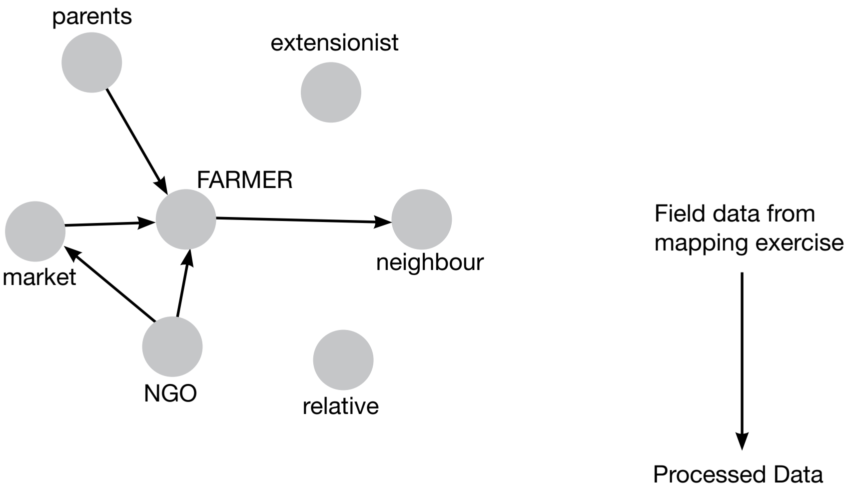
9.3.3. Visualization

These include maps, diagrams and specimens, which are used as visual tools for farmers to articulate their knowledge of a particular subject. Often, these are used to illustrate location, direction, relationship, pattern and trend. Data are represented by symbols, signs and labels which are drawn or written by the participants/respondents/informants.

These visual data are processed through content analysis. This is a method for eliciting meanings conveyed by farmers through symbols as field data, which are then encoded into the database through numerical identities and values assigned to them. Each map or diagram, whether from an individual interview respondent or a group of participants in an FGD session, is considered one unit of observation. A set of diagrams can be encoded, resulting in a database that can be analyzed just like more conventional survey data.

An example is the individual interview where respondents are asked to diagram seed sources using circles and arrows (corresponding to Guide questions 6.1 to 6.3). To encode data on seed sources identified by farmers, the code '1' is assigned to those sources from which there is an arrow pointing to the farmer.

Map drawn by respondent A



RESPONDENT	Parents	Neighbour	Market	Relative	Extensionist	NGO
A	1	0	1	0	0	1
B						
C						
D						

- A list of items is generated based on the presence of symbols that identify particular items. A list can be made of the categories of seed sources as shown as circles in the diagram drawn by the respondent. A consolidated list of seed sources can be made by examining the diagrams (from the completed questionnaires) for every crop within a village or site.
- Frequency is determined by counting the number of times a particular item is shown. Given the same sample diagram as above, the number of times a particular source is mentioned is encoded as frequency data. So if you have 50 diagrams, count the number of circles in each diagram which represent the frequency in which a particular seed source is mentioned.
- Comparisons are indicated by size/colour of a symbol, distance between symbols, or direction of an arrow. During diagramming,

seed sources are compared—whether providing healthy or unhealthy seed—by circling the latter with a red pen. These data are encoded based on comparative lists of items and frequencies. For example, for a neighbour as a seed source, you are comparing how many times a neighbour is categorized as a source of healthy and unhealthy seed. If you have 50 diagrams, look at 'neighbour' as a category and see how many times it has a red circle, since the red circle means it is a source of unhealthy seed, so you can compare the neighbour against all the other seed sources in terms of ratio of healthy versus non-healthy source.

The direction of an arrow can also be encoded by counting the number of arrows pointing to and away from the respondent. These numbers respectively represent the number of farmers/groups which the respondent uses as a seed source, and which ones serve as a seed source for the farmer.

- Patterns and trends are coded in several ways. The first is by generating a list that identifies the types of patterns or trends present. The second is in terms of the frequency with which these patterns/trends occur. The third is through a comparison of a set of items in terms of the degree of increase, decrease, density and similar parameters. Using the same example as above, the diagramming instructions ask farmers to draw a triangle for a known seed source but from which they are not able to obtain seed. The presence of a triangle can form a pattern of 'lack of seed access' when consistently found in the diagrams drawn by farmers.

10. Analyzing participatory diagnosis data

The participatory diagnosis (PD) data are ready for analysis once a database is established through processing. At this point, the various data types have already been systematically transformed into numerical identities and values.

Data analysis is conducted at the site level, done separately for each focus crop. In each crop-specific site-level analysis, analysis is done from a single database which has integrated data collected through various methods (e.g. participatory diagnostic data, secondary data and technical assessment data).

In each site, the total number of analytical reports corresponds to the number of focus crops covered. This crop-specific, site-level report could reflect analysis across villages, FGD sessions and groups. For example, in a project site with four villages, there would be a total of: four outputs of community mapping, a minimum of 240 respondents for individual interview (4×60 respondents), 20 outputs of FGD sessions (4×5 groups) and four outputs of FGD from a particular subgroup (e.g. women).

The basic mode of data analysis for processed/encoded data is through descriptive statistics. Tables of frequencies/percentages are generated from identification and characterization data. The example shown is a table on varieties grown for the current season (from individual interview corresponding to Guide question 1b.4).

Variety planted	% farmers for current year	% farmers in past 5 years

Cross-tabulation is a higher-level analysis which aims to segregate and compare data, thus allowing for simultaneous analysis of two or more variables. The example shown is a table showing criteria of healthy and non-healthy plants and the frequency with which these were mentioned by male and female FGD groups (corresponding to Guide questions 2.1 to 2.10).

Criterion	No. of FGD groups that mentioned	
	Male groups	Female groups
Healthy plants		
a.		
b.		
Non-healthy plants		
a.		
b.		

The above methods produce tables and/or charts that can be readily analyzed for emerging trends and patterns. An observable degree of variability in the data set could provide some basis for deriving conclusions (e.g. on differences, trends).

In addition, the PD database can be statistically analyzed. There are appropriate statistical tests for data drawn from a sample selected through stratified random sampling (i.e. for individual interview with respondents stratified by crop) and stratified purposive sampling (i.e. for FGD with participants stratified by social group).

Among these basic tests are those for establishing significant difference and correlation. Examples are: (1) testing for significant difference in the criteria of crop health identified by male and female farmers, and (2) testing for relationship between level of knowledge and number of years in farming.

More advanced tests—factor analysis, regression analysis—can also be explored for possible use within such limitations of sampling procedure and sample size.

In general, the types of analysis to be undertaken are determined by what outputs (i.e. findings) are required to answer the guide question.

Target outputs of data analysis ***(What tables or charts need to be presented in the report to answer the Guide Question?)***	**Sample guide questions**	**Raw data collected**	**Type of data analysis needed**
Respondents' frequency of changing seeds for each variety	How often do farmers change seeds for each variety?	Number of planting seasons before respondents change seed for each variety	Tests of significant difference between varieties in terms of respondents' frequency of changing seeds
Criteria sorted according to percentage of respondents who mention these	How do farmers distinguish a healthy plant from a non-healthy plant?	Lists of criteria for comparing healthy and non-healthy plants	Computation of percentage of respondents who mention each criterion
Richness and evenness of local crop diversity on farm	What variety do you grow and what is the land area devoted to each variety?	Area covered by each variety per household	Averages for household richness and Simpson Index for estimations of evenness or dominance of varieties on-farm

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